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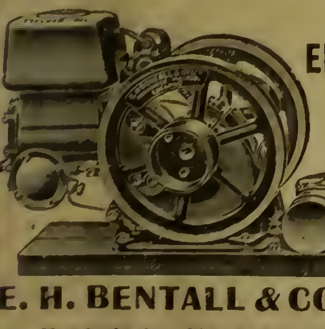

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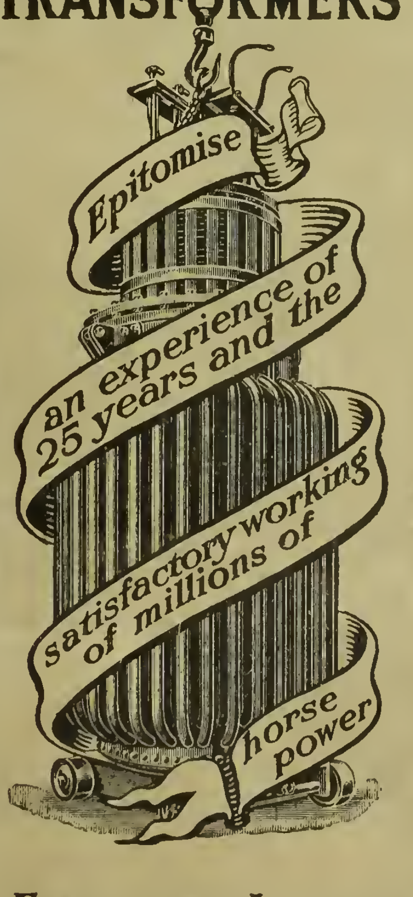

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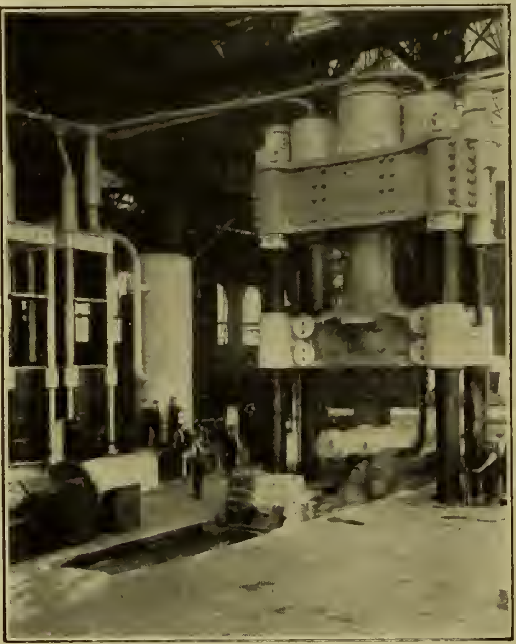

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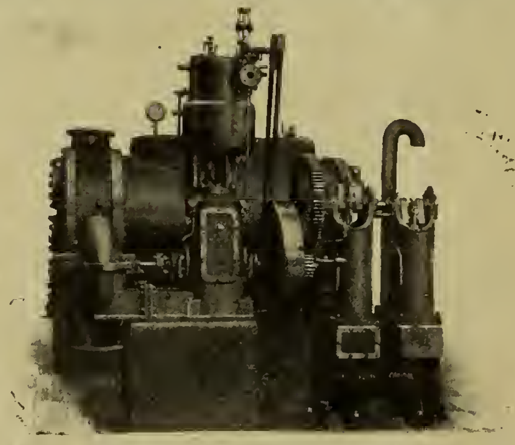

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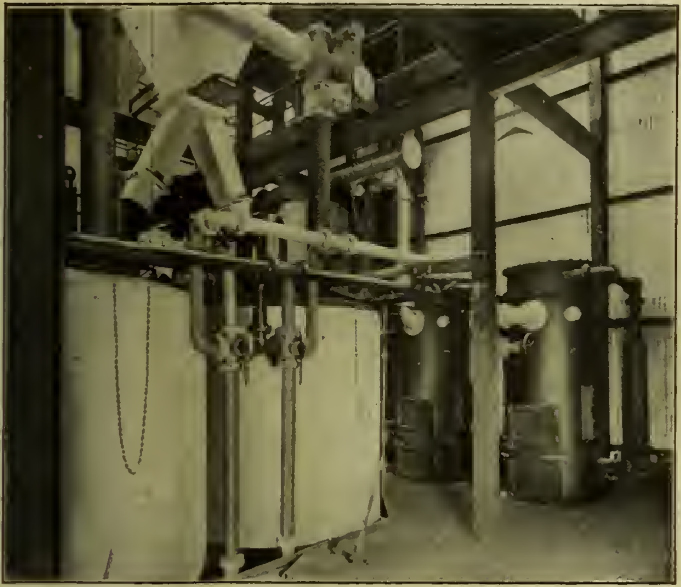

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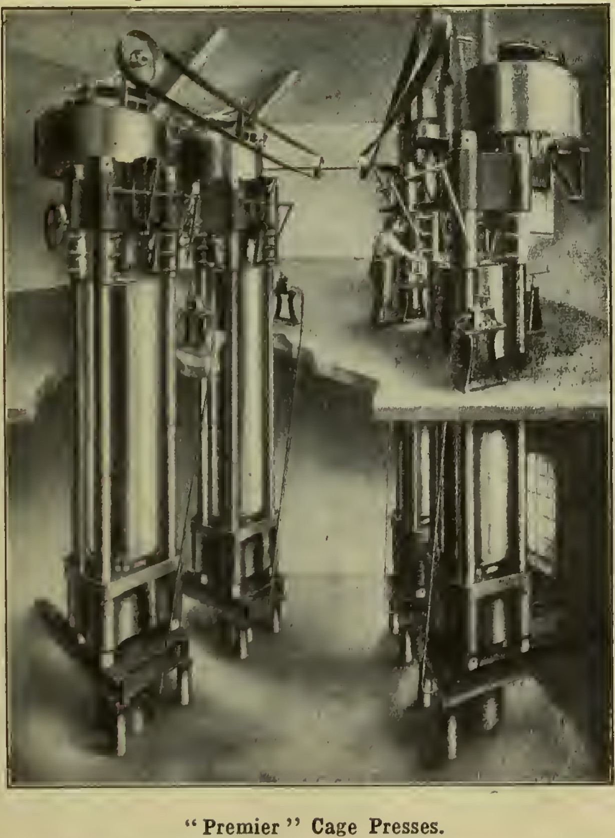

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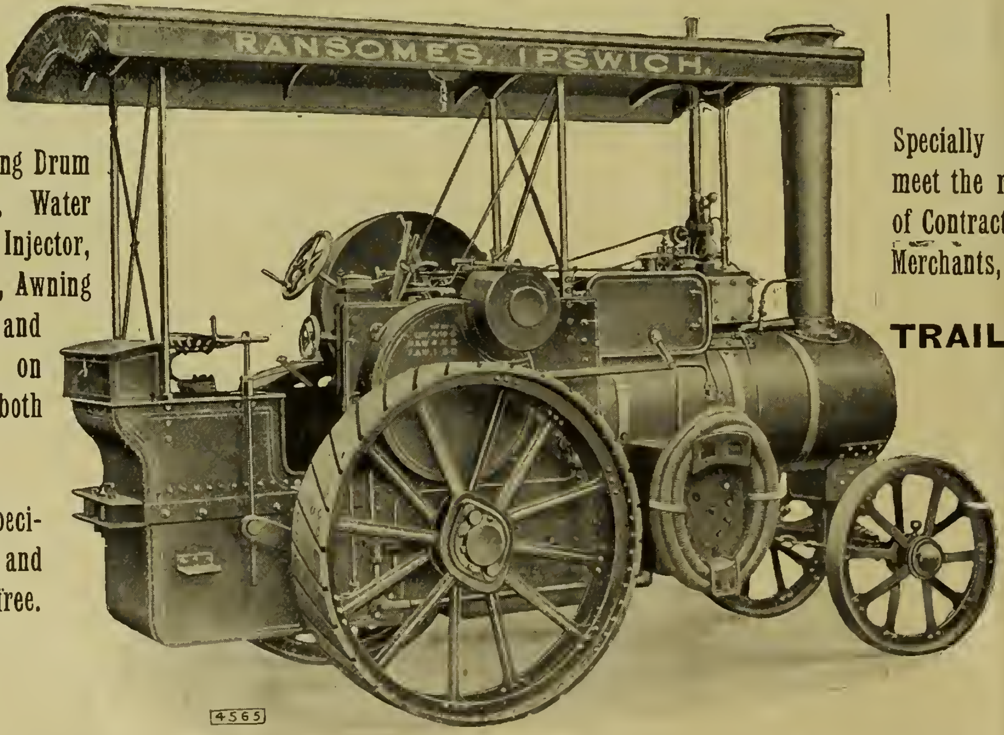

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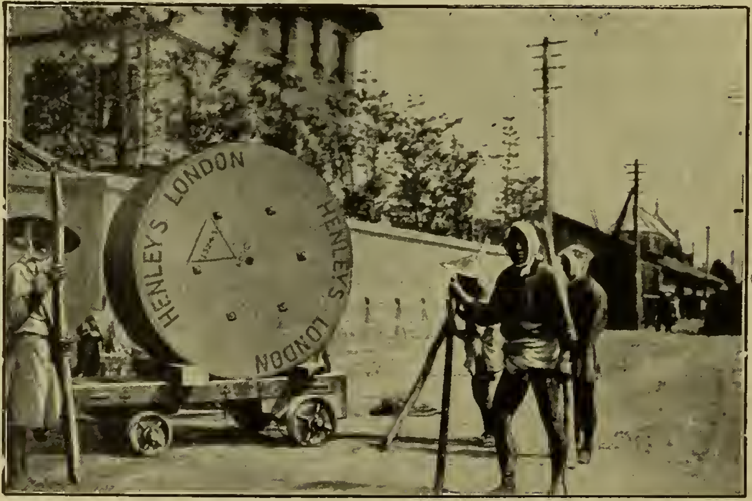

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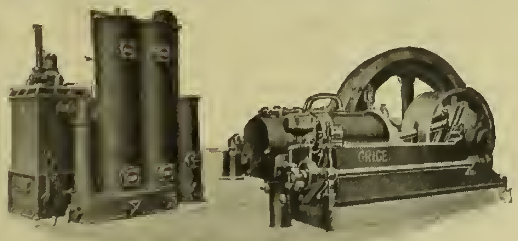

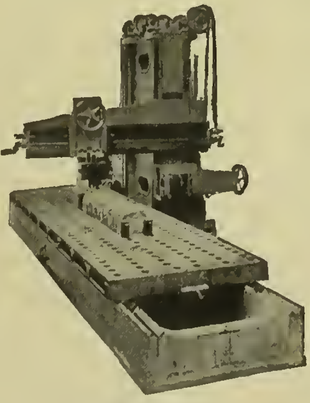

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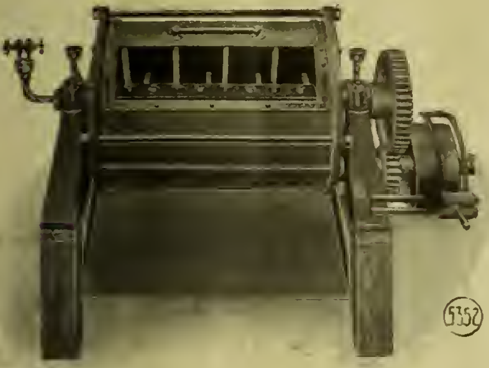

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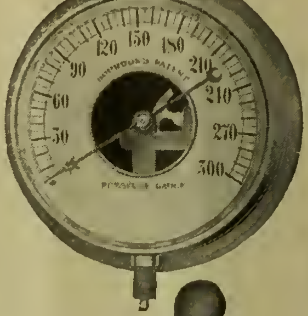

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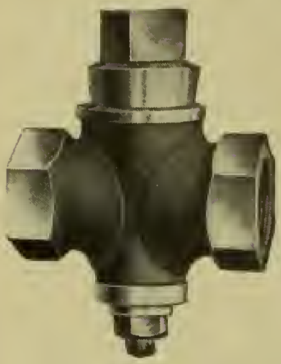

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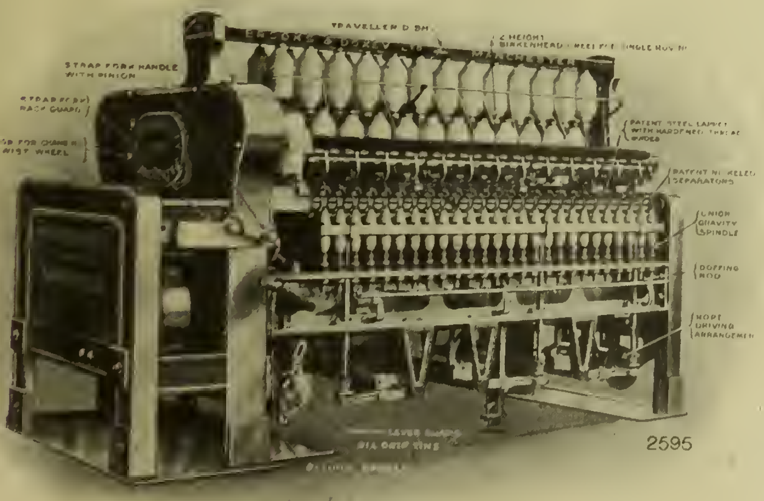

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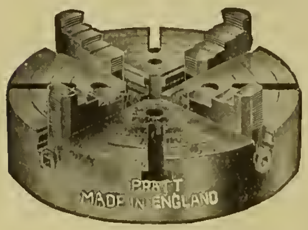

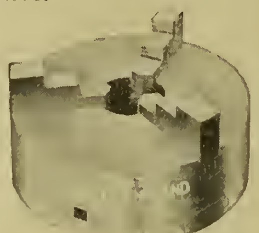

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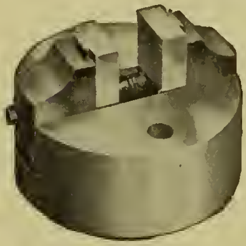

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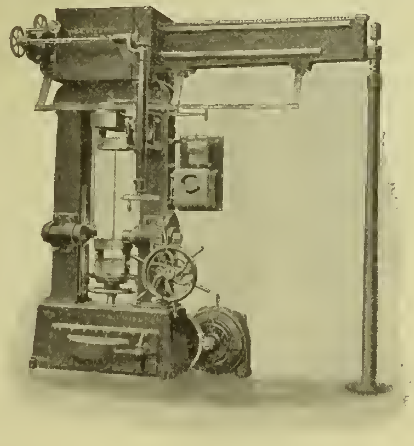

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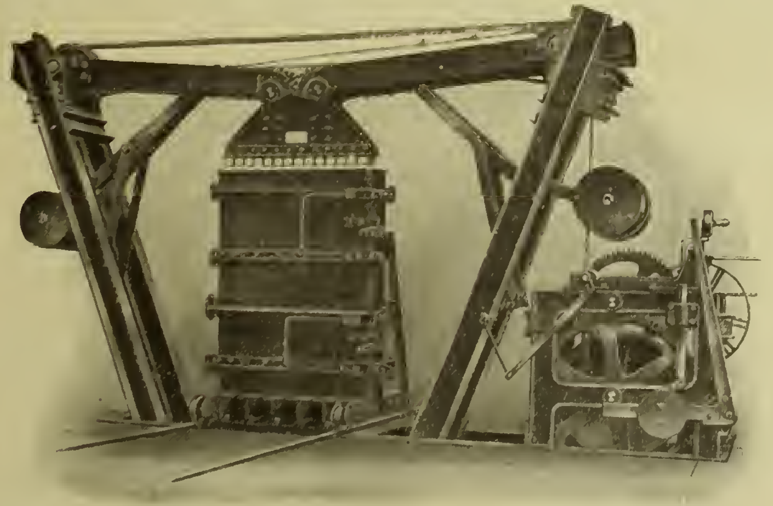

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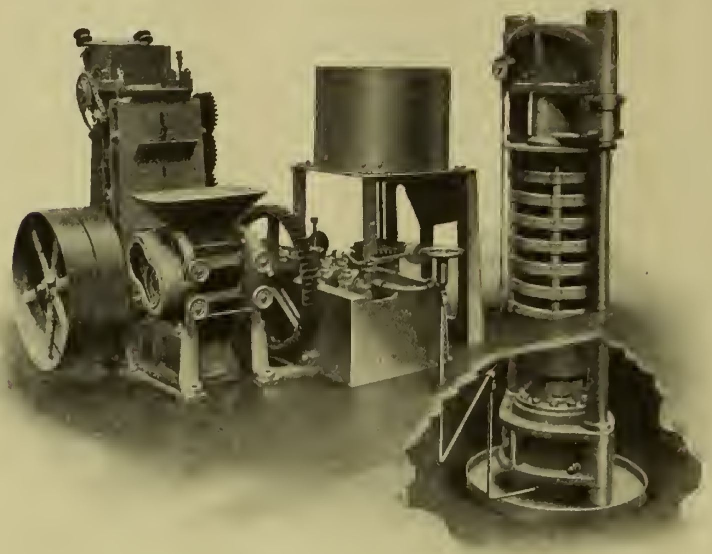

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EASTERN ENGINEERING

Vol. XI.—No. 5.] *MAY 20, 1920.* [New Series.

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NOTES AND COMMENTS.

MAINTAINING BRITISH IDEALS.

Some time back we referred to the Foreign Office Committee appointed in London to consider what steps should be taken by the Government to foster a spirit of solidarity among British communities abroad. This Committee's report has now been issued in the form of a White Paper, and we hold that the recommendations suggested therein are eminently practicable and commonsense proposals. But there is nothing new or sensational about them. Much will depend upon the publicity given to the matter abroad. Without effective and far-reaching publicity amongst British residents in foreign countries nothing material is likely to accrue. We sincerely trust that the matter may be accorded very general notice in the foreign Press and regarded and taken up as a valuable and very necessary proposal by all having British interests at heart. Shortly set out, the proposals stipulate that while the British Government should not interfere with any spirit of independence abroad, it should take a sympathetic interest in the activities of British communities in foreign countries, and in certain cases the Government is prepared to afford them practical support. An effort will be made to secure registration of all British subjects known to be resident in a given district, so that they may be kept in touch with the British Consul, who will furnish their names annually to the Foreign Office. It is desired that every British child abroad should have an opportunity of receiving an English education, and provision thereof is necessary. The formation in foreign countries of British Chambers of Commerce is to be encouraged, and their advice taken on matters affecting trade. Through the media of patriotic societies, churches and other institutions the promotion of British solidarity and the upholding of British ideals is likely to be encouraged, and such media are to be fostered. Commercial propaganda is to be assisted through the commercial side of the diplomatic and Consular services, the organisation of missions to investigate foreign markets, the dispatch of touring exhibitions, and the organisation of showrooms abroad. The increased supply of British technical books and journals is to be strongly urged, and facilities are to be given for their distribution, whilst a Standing Committee is to be appointed to give effect to recommendations approved by the Government. From all points of view the proposals are beneficial, and we discern in them nothing to offend the susceptibilities of other nations.

F.B.I. COMMISSIONER SERVICE.

We have received from the Federation of British Industries particulars of the work accomplished by its Commissioner Service from March, 1919, to February last. Sir Charles Mandleberg is Chairman of the Commissioner Service Committee, and readers may remember that two or three years ago Sir Charles had a very complete scheme of his own for the appointment abroad of representatives of British industry, and this scheme was afterwards merged with the Federation. The broad-minded policy Sir Charles adopted in agreeing to and facilitating the merger is bringing him its own reward in the valuable work since accomplished by the Commissioner Service. Some fifteen Commissioners, Sub-Commissioners and representatives have been appointed in less than a year. Representation of a temporary nature was also arranged in Portugal and in the occupied area of Germany, and arrangements have also been made for honorary correspondents in eight important countries, including China. In addition, a large number of individuals, official and unofficial, have on many occasions furnished and are furnishing valuable information to the Federation. We hope Far Eastern territory will come in for greater attention in the near future. Already an able Commissioner, in the person of Mr. G. O. Blacker, has been appointed for the East Indies. It is the policy of the Federation to keep these Commissioners in the closest touch with the trade developments at home. Arrangements are constantly made for them to return to Great Britain for short visits, and every opportunity is given them to interview manufacturers interested in their markets. The work which the Commissioners are engaged in falls roughly under three main heads—the carrying on of propaganda on behalf of manufacturers' interests in territory abroad, the supply of intelligence to manufacturers at home and in the establishment abroad of confidence in British methods and in the expression to foreign Governments and to official and unofficial bodies abroad of the views and wishes of British exporters. The very best type of men has been selected for the Commissioner Service, and as they are working, or as they should work, in co-operation with the Trade Commissioners of the British Government, their labours should do much to strengthen British interests abroad.

SITUATION IN THE SHIPBUILDING INDUSTRY.

The estimates given in these pages shortly after the close of the war as to the probable relative positions of Great Britain, America, and Japan in the shipbuilding industry have proved to be accurate. Great Britain is steadily increasing her lead. Opinion in British shipbuilding centres is optimistic, both as to the present and future. Many new factors in the industrial situation have, of course, still to be dealt with, and greater co-operation is called for between employers and men in the shipyards. But the spirit of compromise is widespread in Great Britain, and in this is being found the solution of labour problems. The extension and development of new yards are frequent with the larger concerns. Confidence is by no means confined to those centres, like the North of England and the Clyde, closely adjacent to the sources of supply of raw materials, but is also found in other quarters labouring under disadvantages so far as position is concerned. Building in America, we note, has not maintained the degree of activity which was at one time looked for. Complaints of poor American material and workmanship are not infrequent, and construction in Japan has fallen away more than was anticipated, although a setback was predicted. The chief difficulty in the latter country is in obtaining steel. In some directions shipbuilding has ceased to be profitable, owing to the rise in the cost of construction and the fall in the value of tonnage. The price of tonnage has greatly declined since the Armistice, and in some cases it is quoted at only 200 yen. Demands for increased wages are, moreover, fairly constant. There is a delay in shipments of Japanese orders for material from America; in some cases shipments arranged for arrival in Japan in March will not arrive until August or September. During the war the shipbuilding industry in Japan showed the greatest activity in Osaka and its neighbourhood. While it was at its height there were some seventy shipyards active in that part of the country, whereas to-day there are only about twenty But the comparison of conditions to-day with those which obtained in war-time, when an entirely abnormal and artificial state of things existed, has little value, and, if the immediate prospects are somewhat disappointing, the present position is regarded as sound.

FLOATING POWER STATIONS.

A very cursory consideration of Great Britain's naval position will disclose the fact that a large number of vessels are passing out of commision for which, under existing conditions, little real use can be found. Yet the useful life of these ships, considered apart from naval duty, is by no means exhausted. With a view to remedying this state of things it has been suggested for some time past that such vessels could and should be used as floating power stations. This suggestion has called down upon its originators quite a shoal of criticisms, which, however, it may be stated are not more convincing than the proposal the worth of which they question. As an emergency scheme the proposal certainly has attractions, but the high cost of the power so obtained tells heavily against its more general adoption. Nevertheless, the attractiveness of the scheme cannot be questioned, although this may be founded on novelty rather than worth. It has been pointed out that the scrap value of old warships has a value comparable with the cost of a new floating station, but it seems to us that such scrap value would remain after the vessels have filled their mission as power stations. The scheme perhaps attains its most useful phase in connection with the tin mines and rubber plantations of the world. A supporter of the idea has explained that floating power stations could be used with advantage at Port Swettenham, the Dindings and Port Weld, where the swampy nature of the ground would be very bad for ordinary power stations. A paper read some time back by Messrs. Hutchinson and Wayte on "Electricity in Tin Mining in the Federated Malay States," reported in the January and February issues of this Journal, rather deprecated the idea of generating on a large scale in central stations, and probably more economical results could be secured by the Diesel engine or even from the somewhat wasteful portable steam engine using wood fuel. The practical application of the scheme should present no very great difficulty, and industrial interests in the Far East may care to put it to a working test.

BRITISH EMPIRE STEEL.

Many large mergers in the engineering industry have during the past few years been carried through with little apparent opposition or friction, but it does not seem probable that this will altogether be the case with the proposed formation of the British Empire Steel Corporation, with its capital of £100,000,000. Opposition is being restricted, however, to the Canadian Parliament, and, despite the charge of over-capitalisation, opinion is that the project will speedily mature with very material benefit to British industry. Included in the consolidation are the Dominion Steel Corporation and subsidiaries, Nova Scotia Steel Co. and subsidiaries, Canada Steamship Co. and subsidiaries, Canada Foundries and Forgings and subsidiaries, Maritime Nail Co. and subsidiaries, Collingswood Shipbuilding Co., Port Arthur Shipbuilding Co., Halifax Shipyards, and the Davis Shipbuilding and Repairing Co. The Dominion Steel Co. was incorporated in 1910, and is a proprietary concern owning securities of the Dominion Iron and Steel Co., the Dominion Steel Corporation, and the Cumberland Railway and Coal Co. The Dominion Iron and Steel was formed in 1899, and has a capital of $25,800,000 in $5,000,000 7 per cent. cumulative preferred and $20,800,000 common shares. All the latter are held by the Dominion Steel, which likewise possesses $3,500,000 6 per cent. income bonds. There are also $6,379,000 5 per cent. first mortgage bonds, and £1,492,300 5 per cent. consolidated mortgage bonds, of which £1,200,000 were simultaneously offered here and in Canada in 1909. The Nova Scotia Steel and Coal Co. was formed in 1901, and took over all the assets of the Nova Scotia Steel Co. It has a capital of $16,000,000. The Canada Steamship Lines was registered in 1913, and acquired the undertaking of the Richelieu and Ontario Navigation Co. It has a capital of $25,000,000. Vickers, Furness Withy & Co. and the British Machine Trust are substantial shareholders.

AN INTERNATIONAL CHAMBER OF COMMERCE.

In order to facilitate the commercial intercourse of nations, secure harmony of action and co-operation of all business operations, the formation of an International Chamber of Commerce is being actively carried on in London. The preliminary meetings so far held have been chiefly concerned with suggestions as to management and control. National and local commercial, financial and industrial organisations not conducted for profit are eligible for organisation membership and individuals for associate membership, with the privilege of attending meetings and of speaking, but not voting. So far it is proposed that the board of directors shall consist of two persons from each country, or, in certain cases, only one individual from each country. The powers of the directors permit them to determine questions of eligibility of countries and applicants and to receive suggestions from members for subjects to be considered at general meetings and to draw up agenda. A general meeting is to be held at least once in two years. Six months' notice of such meeting is to be given, and the agenda is to be issued four months ahead. Each national federation or organisation is to agree to establish in its own country a national bureau for maintaining relations with headquarters. Or where no national organisation exists, four or more organisation members can elect members of advisory committee, which in turn can set up a bureau. Where no bureau is set up, the headquarters of the International Chamber can communicate direct to members. There is an important field of usefulness for such a Chamber if its work is limited to international matters, and we shall watch developments with interest.

AMERICAN COMPETITION.

As readers who have followed up developments in America will be aware, the Edge Law was recently passed in the States to provide for the organisation of special corporations to grant long term credits to foreign customers. The first of these organisations has just been formed, and is now in business under the style of the First Federal Foreign Banking Association, with a capital of $2,100,000. Eleven representative banking institutions are associated in the new concern. The stockholders in the new bank are manufacturers and banks, and manufacturers who are stockholders will obtain capital for financing their foreign business. The provisions made for granting credits to purchasers of American products will to some extent overcome the difficulties of exchange rates, which are acting as a barrier against American export trade. The aims of the bank, however, cover a wider field, and should certainly help American interests in the Far East, where extended credits are so essential. In the past America has lacked such facilities, in which British manufacturers are better placed. As an indication of American competition the formation of the First Federal Foreign Bank is important, and it shows that Americans are getting over their objection to the investment of capital abroad. The position in Europe has done much to familiarise the American public with foreign investment, for Europe has an indebtedness to the States of $10,000,000,000 in loans, and since the armistice of about $4,000,000,000 in excess of exports over imports. America is busy surveying the whole world in her search for markets for American products. She largely lacks Great Britain's experience in foreign trade, for American business men are very largely ignorant of the economics of foreign trade and of its procedure, and she is without Great Britain's world-wide goodwill in trade and merchant system. As against this America has an enthusiasm and energy peculiarly her own, which render her competition formidable.

TIN IN THE MALAY PENINSULA.

Very general comment is being made on the new tinfield reported to have been discovered in Trengganu, Malay Peninsula. An announcement concerning such reports recently appeared in these pages, and the information contained in this article will, it is thought, prove useful as presenting a general and up-to-date survey of recent developments and present position of the tin industry in British Malaya.

Hitherto, most of the tin found in British Malaya has come from Perak and Selangor. Some few years ago, however, an important discovery of tin-ore was made on the north-east coast of Johore, which exported 3,271 tons in 1917 and 2,346 tons in 1918. The news now to hand from the East is that tin has been found in lode formation extending over a vast area in the State of Trengganu, which lies on the east coast of the Peninsula, to the north of the State of Pahang, where also tin is mined to a small extent.

Trengganu has an area of 6,000 square miles, and a population of about 200,000, located mostly in villages along the coast. They are an enterprising, industrious people, but the State, which came under British influence in 1909 when the suzerainty was transferred from Siam, is the most backward and least explored of all the Malay States. Since 1909, a British Agent has been established at the capital; but until last year, when his status was raised to that of British Adviser on the accession of a new Sultan, he did not take an active part in the local administration. The present adviser is Mr. J. L. Humphreys, a member of the Malayan Civil Service, and better known in this country as one of the leading amateur golfers. In his report on Trengganu for 1918, Mr. Humphreys mentioned that there were only 20 European residents in the State, consisting of eight British miners, eleven Danish planters, and himself The concluding paragraph in that report was as follows:—"The advantages of a sound financial position, an industrious population, and untouched natural resources are at present neutralised by the defective ideals of the ruling classes. If the welfare of the common people is to be improved in proportion to the increasing revenue, some closer form of British control appears to be inevitable." The closer British control, Mr. Humphreys desiderates, has come during the past year; Trengganu is drawing nearer to the Federation's ideal of government and development; there is now a probability of the East Coast Railway being extended to tap Trengganu, which is rather inaccessible by sea; and should the reported discovery of tin prove all that is claimed for it, then Trengganu may, in time, rival the Western States in prosperity and general progress.

It must not be imagined, however, that this is the first discovery of tin in Trengganu. The Bundi mine, near Kuala Kamaman, a privately-owned concern, has been a steady producer for several years. At Bukit Tawang, there is a mine worked by hydraulicking, and the first shipment of tin from it was made in 1913. In the upper reaches of the Sungei Pacca and Sungei Dungun, tin washing by Chinese and Malays has been going on for a number of years, the deposits occurring in small, irregular and rich patches along narrow channels of the smaller streams. But until the discovery now reported, no tin in authenticated lode fomation had been located. Mr. Henry Brelich, A.R.S.M., M.I.M.M., who knows the country well, writing recently, said:—"The discoveries (of minerals) which have been made show that the deposits, so far as they have been exploited, although of limited extent, are of great richness, and of a sufficiently encouraging nature to justify a campaign of more vigorous prospecting being undertaken in that country." The following table shows the export of tin from Trengganu over a period of five years:—

1914	...(tons) 379	£39,867
1915	397	44,255
1916	475	55,825
1917	431	54,535
1918	607	117,356

For some time an expert has been engaged in prospecting a portion of Trengganu, and it is claimed, on his authority, that ore in lode formation has been found in the Kamaman district. The correspondent of the *Straits Times* recently stated that judging from what he and other recognised authorities have found, it would appear that the recent activeness is no exaggeration of some trifling lode or alluvial deposit, but the discovery by experts of what appears to be tin-ore in true lode formation, extending over a vast area, yielding samples of high assays of tin, pure tin oxide. Veins, ranging in width from 15 to 60 feet, have been met with running due north and south through walls of clay slate, the ore being in a sandstone quartzite formation comprising free milling tin oxide. The Bundi mine is in the midst of the new find, and as Bundi is a "lode mine" (a fact which has not hitherto been disclosed) of a reliable character, turning out payable tin for the past 12 or 15 years, it is strange that a more thorough prospect of the country round about it had not been made. But Trengganu is a mountainous country, lacking in transport and covered with dense jungle, and did not encourage the exploitation of Trengganu's natural resources. Of the recent finds, perhaps the most important have been made on blocks within the area of a concession of 100,000 acres approximately. The property covers practically the whole of the Ulu of the Sungei Cherio which runs through the centre of it from east to west, having for its lower or eastern boundaries, on the right the Sungei Triju and on the left the Sungei Brakat, both tributaries of the Cheroi, the Bundi mine being about 18 miles farther down the main river and situated a short distance off the right bank of the Cheroi. The river Cheroi is one of the principal tributaries of the Kamaman, which it enters about 40 miles from the sea.

There are several other concessions and locations in the district, some of which are being worked, situated on tributaries of the Kamaman, notably the Tebak, Sungei Ayam, Sungei Kajang and the Sungei Chendrong, on which latter is the famous wolfram deposit worked by Mr. Tan Wi Yan, the holder of a large concession in that locality.

A correspondent writes in sanguine terms of the prospects. "It would appear almost certain," he says, "that lode deposits so much sought for in the Selangor and Perak districts (States) are to be realised in the Ulus (upper portions) of the east coast rivers, and in such quantities as to relieve the apprehensions of those who may have a doubt as to the lasting deposits of the ore throughout the Peninsula. There are, roughly, 3,000 Chinese labourers employed in mining throughout Kamaman and Trengganu, and there is no difficulty in procuring more at a daily wage of $1.20 (about 2s. 10d.)."

This is certainly good news for those who are interested in tin-mining in British Malaya. Under the new political conditions prevailing in Trengganu, every encouragement is likely to be afforded in the development of the mining industry, though the need of machinery and the difficulty of getting it at the present time may retard the work at the outset.

HIGH-PRESSURE TRANSMISSION LINES IN JAPAN.

The proposed extension of hydro-electric projects in Japan, details of which have appeared in this journal, will involve, it has been estimated, the building of about 1,000 miles of high-pressure transmission lines within the next two years; most of the construction will probably be of the steel-tower type. Aluminium is being considered by the Japanese hydro-electric plants to replace copper in their heavy transmission cables. Copper has been used exclusively for this purpose heretofore, but even with a 25 per cent. duty, aluminium can compete successfully on the basis of price.

Shanghai Electric Construction Co., Ltd.—The profit for 1919 was £154,567, compared with £71,537. The loss by exchange on subsidiary coinage in 1919 was £52,139, which is equal to 16.29 per cent. on the capital of the company. The ratio of depreciation to gross takings increased during the year, and still shows an unfavourable tendency. The traffics and net receipts for the current year continue to be satisfactory. The 15 trailers and seven railless electric cars have not yet been brought into service owing to the difficulties and delays incidental to manufacture.

ENGINEERING, MINING AND INDUSTRIAL PROJECTS IN THE FAR EAST.

POSSIBLE CONTRACTS FOR ELECTRICAL GENERATING PLANT IN SHANGHAI.

Contracts for electrical generating plant for power and lighting are probable in connection with projects for supplying electricity outside the Settlement limits at Shanghai. In the ordinary course the proposed extensions of the electricity department of the Shanghai Municipal Council, as set out in this journal in March last, would have covered such requirements, but such extensions have been opposed on the ground that they are for the benefit of mills and factories outside the Settlement limits, which pay no taxes to the municipal council. It is probable, therefore, that independent power stations may be erected for such outlying establishments. Already works are being erected in Chinese territory in order to obtain power from the native city station. A way out of the difficulty, however, has been provided by the proposal that outlying factories requiring current for power purposes should take up municipal debentures, but a very general response to this scheme is not anticipated.

LARGE SINO-BRITISH MINING CONCESSION.

Whilst it is too early yet to state what reception financial circles in England will give to the projected Sino-British mining corporation being formed under the leadership of the Chinese Engineering & Mining Co., of Tientsin, the importance of the project to manufacturers interested in the supply of the equipment which will become necessary is very obvious. The concession secured is in the Taiyuanfu province, and in addition to the vast coalfields, the new corporation will be permitted to exploit and work iron mines in this Province by the most modern methods. Further, in case of necessity, the corporation will be allowed to build branch railways to connect with the Cheng-ting-Taiyuan and the Peking-Hankow trunk lines. This is reported to be the biggest concession which has been granted to foreigners in recent years in any Chinese province and in this connection the head of the Chinese engineering and mining company of Tientsin is visiting Europe in the interest of the new corporation.

TAKU HARBOUR AND RIVER IMPROVEMENTS.

To relieve the expected congestion at the port of Chinwangtao it is proposed, as mentioned some time back, to make a deep-water port at Taku, at the mouth of the Peiho river, and a considerable scheme of reclamation is now being considered. If this proposal is carried through, the work will be undertaken by the Haihow Conservancy Board, and the Kailan Mining Administration has, it is reported, offered to advance the funds necessary for the work. The creation of a deep-water port at Taku will not only relieve the congestion at Chinwangtao, but will enable the Kailan Mining Administration to export its coal over a shorter rail-haul. Further, the increased shipping facilities will enormously benefit Northern China, and particularly Tientsin, from whence large quantities of wool, oil seeds, etc., are shipped abroad. At present this produce is largely shipped down to Shanghai by coasting steamers, and then transhipped on ocean-going vessels.

It is pointed out that business interests in Tientsin have every reason to be satisfied with the steps taken to rectify the Hai-Ho entrance and reclaim the North Flat. In 1906 the journey up-river took from eight to ten hours. To-day it can easily be done in three hours, or a total of 20 hours from Chefoo to the Tientsin Bund. Ships drawing up to 16 ft. can come up-river without difficulty. The land reclaimed on the left bank of the river would be of sufficient extent to provide suitable wharfage accommodation for 24 steamers 450 ft. long, and the same potentialities exist for works of a similar nature on the opposite bank.

PORT IMPROVEMENTS AT SHANGHAI.

The port congestion at Shanghai has on several occasions been referred to in these pages, and the large improvement schemes now under consideration foreshadow the placing of many important contracts. A clearer conception as to the shape these contracts will take will shortly be possible as a result of the visit to Europe of the engineer-in-chief to the Whangpoo Conservancy Board. It is intended to hold what really amounts to an international conference of expert representatives of leading shipping nations as to the best way to improve the approaches to Shanghai.

DEMAND FOR RAILWAY EQUIPMENT IN CHINA.

There is an active demand for steel freight cars of 40 tons capacity for the transportation of coal, grain, and other commodities in China, as it is estimated that the Chinese railways need 1,000 cars annually for replacements in addition to those needed in connection with new developments. Although it is likely that a considerable number of cars, as well as other equipment, will be built in China in the future, it is not believed that they will be able to supply all their own requirements, especially for locomotives. It is said that the Cheng-Tai Railway is soon to be adapted to the standard gauge between Shih-chiachuang, where it connects with the Kin Han Railway, and Yangchuang, where important anthracite and iron mines are located, a distance of about 75 miles. The present meter gauge will be retained to permit of the use of existing rolling stock, and a third rail will be laid to carry the standard gauge (4 feet 8½ inches) of the Kin-Han rolling stock.

WIRELESS TELEGRAPH STATIONS FOR CHINA.

Under the supervision of a British engineer, wireless telegraph stations are being established between Peking and the farthest limits of Chinese territory in Turkestan.

GREATER WAREHOUSE FACILITIES FOR NAGOYA, JAPAN.

The contemplated organisation of a warehouse company, on a piece of ground on the eastern shore of Nagoya Port, is reported. The plan is to erect a roofed depot for cargo, and to lay a railway to connect the various port facilities. The same company will operate the Ohashi shipyard, which is already in existence.

WIRELESS TELEPHONY IN JAPAN.

In 1919 the Japanese Department of Communications made a series of experimental wireless telephonic communications between land and sea, the land apparatus being of Kobé Central Telephone Office. These experiments proved a success. The Department accordingly recently decided to provide two wireless stations at Kobé and Yokohama from the next fiscal year to open the wireless telephone business for the general public. Though no regulations have been framed, it is probable that the fee will be fixed at about 30 to 50 sen for a conversation.

HYDRO-ELECTRIC SCHEMES IN JAPAN.

The organisation of the Hida-Gawa Electric Company now under consideration is for the development of power from the Hida River, in the vicinity of Nagoya. An alternative scheme aims at the unification of the power supply of Nagoya and neighbouring districts under the control of the Nagoya Electric Light Co., which has bought half of the shares of the Bishu Electric Co., and is negotiating to secure control of the Ichinomiya Electric Light Co., the Inazawa Electric Co., the Gifu Electric Co., and the Yokkaichi Electric Co. As a result of the efforts of the governor, representatives of six big electric companies in Miye Prefecture, the Hokusei, Iwakura, Tsu, Matsuzaka, Ise, and Toba, have been in consultation in regard to a possible combination of all the electric companies within the Prefecture. With the double purpose of obtaining additional income and of controlling water rights, the authorities of Toyama Prefecture are contemplating the establishment of a large hydro-electric plant under Prefectural administration, to develop 37,000 kilowatts of power from the Joganji River. It is expected that this will be sufficient to supply all present demands for power within the Prefecture and leave a surplus to be sold to Kyoto and Osaka. Another power company recently organised in this district is known at the Etchu Electric Power Co., having been granted a license to utilise the Wada River, from which it is expected to develop 10,000 kilowatts of power.

RAILWAY PROJECTS IN JAPAN.

It is stated that Government railway extensions in the near future will include eight new sections, 130 miles in length, to be completed this fiscal year, which will bring the total mileage of the State lines to about 6,170 miles. Of the new sections, four are in Hokkaido, of which the longest connects Atsugeshi and Atsukoto, a distance of 27.3 miles. Three are in the North-Eastern Provinces, the longest being 12.6 miles in length between Akita and Michikawa.

Sakata, a well-known seaport in Yamagata, has been connected with Fukiura by a new section 12 miles in length.

The new section in Shikoku is an extension of the Iyo line, connecting Mishima with Doi. Its length is 6.8 miles. In Kyushu the Sayeki-Kannohara section, 9.8 miles, is to be completed. A new section in Gifu is a branch line, 8.2 miles in length, which connects Gifu Station on the main Tokaido line with Kagamigahara, where the Army has its Air Service Depôt. Along the coast of the Sea of Japan two sections are also to be completed.

Mr. Horne, Commercial Secretary to H.M. Embassy at Tokyo, has prepared the following notes upon local projects; (1) A charter has been granted for the Tokyo subway, but the work will probably not commence for some considerable time. The question is to be brought before the Diet this session, and even if things work smoothly it will be at least two years before operations really commence. The initial plans are for a railway threading Tokyo from the Shinagawa end to Uyeno, with a view to relieving traffic on the existing railways and the original tramway line connecting Shinagawa and Uyeno. The next move would be a branch from somewhere near the Uyeno end to Asakusa, to be followed by a branch at the other end in the Meguro direction.

(2) Many years ago there was a scheme for a high-speed railway between Tokyo and Osaka. This has been revived with some strength, but the plans are not at all definite. The general opinion seems to be that the project will materialise and place Tokyo and Osaka within six hours of one another. The project will be started as a private enterprise, in which all the big Japanese capitalists are interested, and subsequently turned over to the Government.

(3) The traffic problem of Tokyo is becoming very serious, and is engaging the attention of the Government. A special Investigation Committee has been appointed, and has drawn up a very full report dealing with necessary extensions above the ground, on the ground, and under the ground—high speed, low speed, electrification, etc., etc.

(4) Another project is the electrification of the Tokaido Railway from Yokohama to Kobé by stages. This also is very much in the air, but there is considerable agitation to make a start, commencing on the Kyoto-Kobé run.

(5) The line between Yokohama and Yokosuka will shortly be electrified.

RAILWAY DEVELOPMENTS IN KOREA.

The construction of a light railway has been commenced between Hamhcung and Huchang, aiming at the exploitation of North Korea along the Yalu.

In July last permission was granted for the laying down of a light railway, which is to serve in the exploitation of forests along the Tumen and the Yalu. This railway, to be styled the Ryoko Takurin Tetsudo (Railway for Forest exploitation along the two rivers), will consist of two lines, viz. :—

(1) From Komusan (on the Chongijin-Hoilyong Railway) to Masan;

(2) From Kilju (in North Hamkyong Province) to Heisanchin. This will be broad gauge, and the total length of the two lines will be 205 miles.

A company, with a nominal capital of 15,000,000 yen (about £1,600,000) will be formed for the execution of the scheme. It is expected that the new enterprise will be a paying business, for, besides forests, the districts to be traversed are thought to be rich in minerals, and the railway will stimulate the industrial development of this hitherto neglected region.

In October a statement appeared in the Seoul press to the effect that the Oriental Development Company intended establishing a railway in Western Korea with a subscribed capital of 10,000,000 yen. As soon as permission has been obtained, 30,000 of the company's shares will be put on the market, and it is hoped that construction will commence early next year.

A big railway company, called the Hokusen Tetsudo Kaisha (North Korea Railway Company), capitalised at 10,000,000 yen, is in course of organisation. It is understood that the first section will be taken up at Lajin, a port in North Hamkyong Province, so as to establish connection with Hunkei via Ungkeui, Kyongheung, and Keundong, a distance of 83 miles, while the second section will connect old Kanwon with Hoilyong on the Chongijin-Hoilyong Railway, a branch connecting with the Tienpaeshan Light Railway via Onsong and Changsong. A survey of the route has already been made, so that it is expected that the plan will shortly be carried into execution.

The total mileage of broad-gauge lines in Korea is at present 1,159. As regards light railways, lines already constructed cover 187.8 miles, while projected lines are to extend for 1,502.8 miles, of which 28.6 miles are now under construction.

JAPAN'S PROJECTS FOR ENCOURAGING BEET-SUGAR INDUSTRY IN MANCHURIA.

A good deal of equipment will be required as Japan's plans for developing the beet-sugar industry in Manchuria nature. The matter has already received very considerable attention in the local Press. As the annual sugar production of Japan is little more than half of the amount locally consumed, and as the action of Java in prohibiting the exportation of sugar for the next six months emphasised the possibilities of future shortage of sugar in Japan, the Japanese are realising the necessity for developing a more dependable source of supply. To this end they have offered rewards to the farmers of Manchuria for large crops of sugar beets, and thus encouraging them to plant beets instead of their customary crops. According to the annual report of the South Manchuria Sugar Co., the yield last year was twice that of the previous season, in spite of the unfavourable weather and the reduced acreage. This was due to careful selection of lands, seeds, and fertilisers, and the adoption of modern methods of cultivation.

THE COCONUT INDUSTRY IN MALAYA.

Next to rubber, coconut growing is the principal agricultural industry in the Malay Peninsula, and with an increasing demand for vegetable oils there is reason for hoping that the industry may enjoy greater commercial prosperity than in the past. Several well directed projects towards this end are under consideration, and experiments are being carried on by the Agricultural Department to ascertain the best methods of cultivation, the more prolific nut-bearers and the most suitable soils. Special attention in development schemes is being given to the dwarf coconut, known in Malaya as "nyiur gading," or ivory coconut. This type is remarkable for its early fruiting. The "meat" is said to be richer in oil and sweeter in taste than that of the big coconut, and it is therefore more popular with them for domestic purposes. In 1912 500 acres were planted with these dwarf nuts at Sungei Nipah Estate, on the coast between Port Dickson and Sepang Point, and this is probably the only estate of dwarf coconuts in the world. The profit per acre from five-year-old dwarf coconuts to-day can, it is claimed, even stand comparison with that of rubber, and the man who is planting to-day has to consider markets five years ahead, and might do worse than place confidence in the dwarf coconut.

MOTOR-CARS FOR MALAYA.

Strenuous efforts are being made by American agents to popularise American-built motor-cars, both for pleasure and commercial purposes, in both the Federated Malay States and in the Straits Settlements, and although there is a marked preference for cars of British manufacture, there is difficulty in obtaining these of the desired type and at a low price. There are, however, several efficient types of British manufactures thoroughly well suited for this market. The representation of their makers' interests offers a remunerative prospect, and this journal will gladly place agents in touch with the manufacturers on receipt of particulars.

IRRIGATION IN THE PHILIPPINES.

The Department of Commerce and Communications in the Phillippines will release an average of $2,500,000 a year on irrigation projects before the end of 1930. Twenty-five million dollars have been appropriated for this purpose and the amount is deemed sufficient to establish modern irrigation throughout the islands of the archipelago. Besides developing irrigation, hydro-electric sites will be improved and power produced. The irrigation system will ensure rice production on a regular basis.

MOTOR VEHICLES FOR BURMAH.

The use of motor vehicles in Burmah is steadily extending, and light, durable cars at a moderate price are best suited for this market. Burmah has 1,920 miles of metalled roads, and 10,339 miles of unmetalled roads. The latter are often in poor condition, particularly in the delta region of Lower Burmah during the rainy season. In Upper Burmah the ground is generally dry and hard, and the region is hilly, so that good roads are few. At present there are about 1,725 passenger automobiles, 126 motor trucks, lorries, and busses, and 976 motor cycles in Burmah. Trucks and lorries are employed by the wolfram and tin mines and rubber estates, in the oil fields, in the region of the ruby mines at Magok, for transport in the city of Rangoon, and from railway stations to seaport or river port.

MODERN ENGINEERING PRACTICE.

ECONOMY OF GAS FIRING IN INDUSTRY.

Very convincing evidence on the economies secured by the application of gas to industry is forthcoming from a large engineering works in the North of England. The cost of gas with oil and then with coke is compared in the processes of heating spring buckles and round longitudinal stay rod end for locomotive boilers before "heading." In the gas furnace used for this work the cost of gas consumption was 1s. 3d. per hour, as against 3s. 1¼d. per hour with the oil furnace it displaced, and as prices were on the rise the comparative difference was actually greater than these figures represent. The same industrial area specialised in the manufacture of colliery tipping tubs, one of the requisites for this work being the regular provision of ½-in. rivets. Gas performed the work at a minimum of cost for fuel; the figure being 2s. 9½d. per 8-hour day, as against 5s. 7d. per day for coke for the same output. In another case, the operation of which was the normalising of certain small articles hammered out of mild steel wire, in which four solid fuel furnaces were replaced with four low-pressure gas and six furnaces of similar dimensions, an increase in the output of 223 per cent. was secured, and the actual cost of fuel was 70 more with coke. Compared with a coal furnace, gas gave an increased output of 10.76 per cent., cost of ton of forgings was reduced by 51.6 per cent., and the percentage of virgin coal saved was 80 per cent.

PURIFICATION OF AIR BY ELECTRICITY.

Experiments were recently conducted on the purification of air by electrical means, the contaminated air being drawn through a copper tube in the axis of which was a wire maintained at a negative potential of 50,000 volts with regard to the tube. Although the air was proved to contain originally 150 microbes per $m.^3$, after electrification it was absolutely sterile. As experiments with dust particles had shown that the best results obtainable did not exceed a deposition of 95 to 97 per cent. of the particles, it is concluded that the destruction of the microbes was partly due to the action of ozone, and future researches will be directed to this aspect of the matter.

CONCRETE TANKS USED FOR WATER STORAGE.

The American test of concrete tanks made of 1:2:4 mixture and used for water storage has been discontinued after 150 days, because the day-loss curves have taken the form of a straight line, showing that the daily loss has become constant. It may be of interest to note that these tanks, although showing some actual loss, due to water penetrating the concrete, remained dust dry on the exterior. It would seem from this that although the head of water amounted to 35 feet, the 1: 2: 4 concrete is sufficiently waterproof for this purpose.

UNDERGROUND TRANSPORT IN MINES.

Modern experience in underground haulage in collieries makes out a very good case for the employment of either the compressed air or electric locomotive. Economical considerations and considerations which make for safety are, of course, the chief factors governing approved practice. For purposes of comparison, the term of the tonne-kilometre, equally 0.612 ton mile, is used. A fair day's work for a horse employed in underground haulage is about 50 t.-km. Internal combustion locomotives of 8 to 12 h.p. in use in many collieries have a tractive power on the level of 270 to 400 kg. respectively, and a speed, with a normal load of 6 km. (3.73 miles) per hour. Such locomotives become more economical than horse power as the product of the distance and load, or the traffic intensity, reaches 120 t.-km. The speed of the electric accumulator locomotive under a normal load is about 10 km. (6.21 miles) per hour. It occupies less height than the oil-driven machine. Compared with horse haulage it becomes superior in economical working when the traffic exceeds 240 t.-km. The compressed-air locomotive has found a wider application, chiefly because it is not a source of danger in an explosive atmosphere. Moreover, its exhaust tends to purify and cool rather than to vitiate and heat the air of the mine. This locomotive possesses the merit of small dimensions, which makes it suitable for thin seams. Its speed is from 10 to 12 km. (6.2 to 7.45 miles) an hour. A compressor capable of compressing from 5 to 6 cu. m. (176.6 to 211.9 cu. ft.) a minute is sufficient to run one locomotive. The running costs, which are high for a small output, decrease rapidly as the loads to be hauled increase. Its superiority over horse haulage, from the economical standpoint, begins when the traffic intensity reaches 220 t-km. The electric locomotive supplied with current from a power station is steadily winning a foremost position, due to the many advantages it possesses over the other systems. It is easily controlled. Its speed, up to 12 km. (7.45 miles) an hour, can be regulated with precision. For a given power it is lighter than any other. It occupies less space, and is more easily kept in good order. The current wires are simple and quickly fixed in position, and when installed may be used for lighting and shot-firing. The cost of an installation is less than half that of the compressed-air system. The electric locomotive, moreover, does not heat or vitiate the atmosphere of the mine. But the possibility of sparking makes it unsuitable for use in a fiery mine. From the economical point of view it is superior to all other forms of motor. In the light of these recommendations it is interesting to note the Home Office regulations concerning mine locomotives obtaining in Great Britain. Under these, haulage by electric locomotives on the overhead trolley wire system is prohibited in any mine in which coal is worked, but haulage by storage-battery locomotives may be used in any mine, with the consent in writing first obained of the Secretary of State, and subject to such conditions affecting safety as may be prescribed by him. The use of internal-combustion locomotives is prohibited by the Act.

PRACTICAL RULES FOR EARTHING.

The following rules on the earthing of electrical machines and installations have been justified by experience. Whilst the question of earthing windings and live parts is a controversial one, particularly with regard to the earthing of the neutral points of three-phase alternators and transformers, instruments and instrument transformers, on the other hand, must have their cores and windings earthed, also arresters, etc. The earthing should be done by means of a copper conductor containing as few bends as possible, of section calculated at 1 sq. mm. per 10 amperes of the normal load current of the apparatus or installation to be protected, with a minimum of 10 sq. mm. This refers only to the earthing of machine frames and parts liable to be traversed by the full short-circuit current. The earth contact should be a sheet of galvanised iron at least 5 mm. thick, or a copper sheet at least 2 mm. thick, placed in a bed of coke breeze 50 cm. thick. If a sheet of water is available, the earth contact may be a metal cable or pipe immersed therein. In either case, the surfaces and lengths must be such that the resistance of the contact shall not exceed $R = 50/I$, I being the maximum short-circuit current, equal in A.C. to $E\sqrt{C/L}$. Therefore, $R < (50/E)\sqrt{L/C}$, L and C being the machine constants. In practice $\sqrt{L/C}$ generally averages 70. We may thus take $R < 3{,}500/E$, with a minimum of about 5 ohms. For direct current, R can be taken as between 5 and 10 ohms. For earthing arresters, the earth wire should be of 50 to 100 sq. mm., and the earth resistance not over 10 ohms.

GAS AND OIL ENGINE ACCIDENTS.

Much valuable advice as to the prevention and cure of accidents to gas and oil engines is contained in a little book just published by the National Boiler & General Insurance Co., Ltd., of Manchester. Failure of the crank-shaft is still a cause of frequent breakdown. It is generally due to overstress. It most often occurs in that portion of the shaft between the crank and the fly wheel, and those portions of the shaft most subject to stress should be carefully examined every time the crank pin or journals are beared. The spring test of a shaft offers a useful method of locating a suspected crack. Place a chock of wood or a plank under the crank web and then exert a pull on the fly wheel rim so as to put the portion of the shaft which contains the suspected crack under torsion. The surface should be rubbed quite clean to commence with, and if there is actually a crack it will show up after sharply pulling the fly wheel a few times, as oil will commence to exude from between the fractured surfaces. Anything which causes a shock at the moment of explosion is likely to overstrain the shaft, and an engine which has been subject to pre-ignition, or has been worked with a slack fly wheel key, is very likely to break down sooner or later with a fractured crankshaft. The sticking or seizing of the piston is another cause of overstress, as is the irregular application of the load. Bearings out of line may cause fracture across the webs. Connecting rod bolt failure is another frequent cause of failure in internal-combustion engines. Bolts break by overstress through faulty adjustment of brasses. Other causes of overstress are pre-ignition, seizing of the piston, and use of excessive force when tightening up. Connecting rod bolts should be renewed every three years. Overheating due to defective water circulation is the most common reason for cylinder castings cracking. Scale in the pipes and jacket is a common cause of trouble, and hard water should not be used. The risk of a cracked jacket owing to frozen water should obviously be guarded against. Many gas engines are in use only at irregular intervals, and with such engines it is necessary to guard against the risk of a cracked jacket owing to the water freezing. A safe plan is to drain the jacket, but when that is done it is necessary to make sure the stop cock is tight.

THE IRON AND STEEL INSTITUTE.

BRITISH PROGRESS IN THE FERROUS INDUSTRIES.

The annual meeting of the Iron and Steel Institute was held in London during the month, with the exception of the final session held at Sheffield. Total membership now reaches 2.181. Dr. J. E. Stead, F.R.S., succeeds Mr. Eugene Schneider as President of the Institute. As announced last month, the Bessemer Gold Medal for 1920 has been awarded to Mr. Harry Brearley. Mr. Brearley was born in 1871 in Sheffield. He started on the steel-making plant at the age of twelve, and from the most modest beginnings became a metallurgist in Russia. He has now been consulting metallurgist in public and private capacities for twenty years. He was works manager at Brown Bayley's Steel Works during the war, and is now technical director of this and other companies. Mr. Brearley is the discoverer of "stainless" steel and the author of many technical books.

Special value this year attaches to the Presidential address by Dr. Stead, who first entered a metallurgical establishment fifty years ago in the capacity of analyst. Dr. Stead's address gave a condensed review of the progress made during that period in the ferrous industries, including:—(1) Blast furnace: (2) puddling process: (3) science in the foundry: (4) basic Bessemer and basic open-hearth processes: (5) electric furnace: (6) production of sound ingots: (7) recognition of science: (8) advent and progress of metallography: (9) application of science to the ferrous industries: (10) encouragement of research: (11) technical education.

In reviewing past and present conditions, Dr. Stead drew the following conclusions:—

(1) There seems to be no advantage in having the capacity of the blast furnace above 30,000 cub. ft.

(2) The working of furnaces is best controlled by having a separate blowing-engine for each furnace.

(3) If increased output per furnace is desired, this can be attained by widening the diameter of the hearth and increasing the volume of air blown in.

(4) All the available gases should be conserved by the adoption of the double bell, or other similar system of charging the materials.

(5) Having secured all the gases, means should be used to obtain a maximum proportion of their calorific value by freeing the gases from dust, by most carefully controlling the proportion of air for their combustion, and avoiding excessive heat being lost in the escaping gases.

(6) The coke ovens should be close to the furnaces.

(7) The coke should be handled as little as possible after it leaves the coke ovens so as to avoid the production of fines, and should be sufficiently hard to resist crushing.

(8) As coke in fine condition tends to disorganise the regular working of the blast furnace, and reduces the output of pig, the "fines" should be sieved off and the consolidated material charged into the furnace.

(9) There is sufficient evidence to show that, given efficient gas engines, it is advisable to use them in preference to steam engines.

(10) It is highly desirable to study how to recover the heat carried out of the furnaces in the slag.

(11) Having obtained by all the available means the maximum saving in heat, and having much more gas and heat from the blast furnaces and coke ovens than is necessary for the requirements of the blast furnaces, it seems probable that in the case in which coke ovens, blast furnaces, and steelworks are grouped together, sufficient gas will be available to do all the heating at the steelworks without using any raw coal,

(12) Having cleaned the gases, and having by the use of common salt or otherwise obtained dry dust sufficiently high in potash to justify its extraction, the potash should be recovered.

(13) The question of using dry blast should, in view of the high price of fuel, be most carefully reconsidered, for, if anything like a saving of 15 per cent. coke can be effected by drying the air, it should pay to do it.

BASIC OPEN-HEARTH PROCESS.

Messrs. Bell Bros. worked their chrome-lined open-hearth furnaces at their Clarence works for only two years, after which they were dismantled, and in 1898 new furnaces were erected and worked under the control of Messrs. Dorman, Long and Co. From the first, instead of cold pig, liquid iron direct from the blast furnaces was used: no special quality of iron was made, but, as there were many blast furnaces from which to draw the metal, only that low in silicon and rather high in sulphur, such as foundry 4 or forge irons, was selected. Saniter, having by his desulphurising process at Wigan made it possible to deal with metal high in sulphur, was engaged to apply his process at the Clarence installation. The results were perfectly successful, and it was proved for the first time that ordinary Cleveland iron of forge quality low in manganese and rather high in sulphur could be readily made into perfectly good steel. An active mixer was afterwards introduced, and the silicon in the metal was reduced from about 2.2 to 1.2 per cent. From that time the works were extended to the present day and steel of the highest quality produced. After the success at Clarence, the open-hearth furnaces making steel from hematite pig at the Britannia Works of Messrs. Dorman, Long and Co. were changed to the basic process, and were worked on the same lines as those at Clarence, with equally successful results.

In 1919 a completely new steelworks was started at Redcar by Messrs. Dorman, Long and Co., in connection with the Redcar and Coatham blast furnaces. The plant is quite up-to-date and consists of a 400-ton mixer and nine 70-ton open-hearth furnaces—five of which are working and four are in course of erection. Each furnace yields about 800 tons per week. The waste heat from the furnace gases is partially recovered by passing into boilers of special construction. The quantity of coal used per ton of ingots for the mixer is $1\frac{1}{4}$ cwt. and for the steel furnaces 5 cwt., including that used for heating up.

The following particulars of the details of working a modern steel-making furnace by the ore and molten pig process at the Clarence Works have been furnished by Messrs. Dorman, Long and Co., and are typical of what is done at each of their works. Into a fixed furnace of 50-ton capacity are charged:—Gellivare ore, 10 tons 0 cwt.; limestone, 7 tons 2 cwt.; cold pig-iron, 4 tons 12 cwt. After the materials are beginning to melt, 46 tons 6 cwt. of molten metal from a mixer are poured into the furnace. The metal percolating between the partially-fused ore and lime has a large surface exposed to the refining material, and desiliconisation and dephosphorisation are rapidly effected.

The late Mr. H. S. Bicketon Brindley.

Notes on Mr. Brindley's career appeared in our last issue, and the above portrait has been forwarded to us by Mr. Stafford Ransome, for long a close friend of the deceased gentleman. It will be seen with very real interest by many readers who had friendly or business relations with Mr. Brindley in the Far East. Mr. Ransome points out that when he founded this Journal on behalf of British engineering interests in July, 1911, he was largely influenced and aided by the advice and assistance of Mr. Brindley, who was at that time a director of the proprietary Company.

After a time the cinder, more or less saturated with silica and phosphoric acid, froths and boils, and is allowed to escape from the furnace by special outlets. When the materials are quite fluid and the frothing subsides, samples are taken and analysed, and based on the result of this analysis the requisite amount of lime and oxides are charged into the furnace; at intervals samples are taken of both metal and slag, which are analysed. Guided by these, more lime or oxide, or both, are charged, and 5 cwt. of fluorspar. The sulphur and phosphorus can be reduced below 0.04 per cent., at the expense of lime, iron ore, and fluorspar. It is interesting to note that this—the process now generally used—is almost exactly that developed by the late J. H. Darby.

ELECTRIC FURNACES.

Previous to the war only a few electric furnaces were used in connection with the iron and steel industry in Great Britain, but soon after 1914 a large number of melting furnaces—mainly of the Hérault type—were erected in Sheffield and other parts of the country to deal with the enormous mass of shell borings produced in every part of the country. They have been used largely to replace crucible melting, and have come to stay. Immense quantities of special alloy steels were made by their aid, and since the war, in one works at least the greater part of crucible steel has been replaced by electric steel. The possible production at the present day, if all furnaces were worked to their full capacity, is about 300,000 tons a year.

One of the latest advances in connection with electric steel is to melt it in an induction furnace in vacuo. Mr. Albert Hiorth, of Christiania, has designed a furnace particularly adapted to effect this object. The steel, after being melted in vacuo in the ring furnace, is allowed to cool down without admission of air into the furnace. The steel is then removed and cut up into sections for forging. By this means steel free from honeycomb and gases is obtained. It is, however, probable that the process is likely to be applied only for very high qualities of steel.

METALLOGRAPHY.

Dr. Stead's address in this Section briefly outlined " the birth of metallography,'' and its subsequent development, including the work of the pioneers, Sorby and Arnold, Osmond and Le Chatelier, Howe and Sauveur. Both Osmond's allotropic theory and Sir W. Roberts-Austen's carbon theory are duly discussed, and in going over the arguments for and against the two theories in the light of more recent research, says Dr. Stead, one must conclude that although the minds of a host of earnest workers have been and are still devoted to the subject, we do not yet know exactly why quenched steel is so intensely hard. All agree that without carbon such hardness cannot be obtained. One thing is certain, however. When scientists of high degree differ so fundamentally, quite a multitude of students and others begin to work in the field in order by research to arrive at the truth. Although they have not been rewarded by finding what they sought, they incidentally found many other things, adding greatly to our knowledge. This activity went far to placing metallography on its throne.

SORBITIC STEEL.

Osmond, by the microscope, proved that the tough improved condition of steel produced by heat treatment was due to the presence of sorbite. He stated that it was probable that the present methods in the manufacture of rails, etc., would eventually appear primitive, and he hoped that " the greater quantity of pearlite in our steel would in future be replaced by sorbite." Richards and Stead attempted to produce sorbitic rails by spraying the upper surface of rail heads with water after they left the rolls, but the crude process of spraying was difficult to control, and occasionally cracks were produced on the rail heads. The process was therefore abandoned. Within recent years, however, Messrs. Sandberg, by substituting a blast of cold air for water spray, produced the desired carbon condition, and rails treated in that way have given exceedingly good service on railways and tramways. Treatment of a more drastic nature is being obtained by the same gentlemen by heating to above the critical points, Ac1, the tread of tram rails in the permanent way by the oxy-acetylene blowpipe flame, and the chilling of the metal so heated is effected by jets of water immediately following the flame. A layer of about 3-16 in. is thus converted into martensite, which merges gradually into the normal structure. The Sandberg sorbitic treatment has not been confined to the hardening of rails, but has been successfully applied to tyres also.

The inventors claim that, unlike the present system of oil-hardening and tempering, the Sandberg treatment can in no case make the steel brittle. It is immaterial whether the treatment starts a few degrees higher or lower in temperature so long as the temperature at the start of the treatment is well above the higher point of the critical range. They believe that if railway engineers realised how reliable and efficient the method really is, they would certainly specify the Sandberg treatment generally.

Amongst the most important Papers subsequently read or submitted were contributions on " British Blast-furnace Practice," by F. Clements; "The Valuation of Ores and Iron-making Material," by C. H. Ridsdale; and " The Economical and Thermal Conditions in Blast-furnace Practice," by H. E. Wright. Mr. C. A. Ablett furnished a Paper on " Direct Current Compared with Three-Phase Current for Driving Steelworks Plant," and Mr. Jno. F. Wilson a Paper on " Slag Conditions in Open-Hearth Basic Steel-making Practice." Other Papers included notes on the " Reduction of Silicon from the Slag in the Open-hearth Process '' and " The Design and Treatment of Steel Castings.''

ELECTRICAL PRECIPITATION OF DUST FROM SMELTER GASES.

Particulars furnished by the Metallurgical Research Institute show that a number of electrical precipitators on the Cottrell process have been installed in Japanese smelters since 1918. The installations, it is pointed out, are similar, consisting of from one half to ten repeated sections, each containing 64 pipes, 12 in. in diameter and 16 ft. long. Ordinarily one motor generator serves two sections, each set comprising a 15-h.p., 50-cycle, 500-volt, 3-phase motor, a 10-K.V.A., 50-cycle, 200-volt generator, and a 10 or 15 K.V.A. transformer capable of giving 100,000 volts on the secondary. Results, however, vary, and in certain cases special treatment is necessary, according to the nature of the furnace charge, the amount of moisture present, and temperature.

In the case of the Askio smelter, Furukawa Mining Co., the amount of dust collected varies from six to 10 long tons per 24 hours. When conditions are favourable an efficiency of 98 per cent, is obtained. In this installation two treaters were installed in 1918—one to treat the mixed gases from four McDougall roasters, two copper blast furnaces, and four converters; and the other to treat the gases from a reverberatory furnace after having passed through waste-heat boilers.

The gases are drawn through the main treater and discharged directly from the fan casings, while those of the reverberatory furnace are drawn through the reverberatory treater by the natural draught of the stack. As the reverberatory furnace is not operating continuously at present, the gases and those of eleven pot roasters, four blast furnaces and four copper converters are mixed and treated entirely by the main treater. Thus the gas volume now handled by the main treater seems somewhat in excess of 150,000 cub. ft. per minute as designed. The amount of dust collected varies from six to ten long tons per 24 hours.

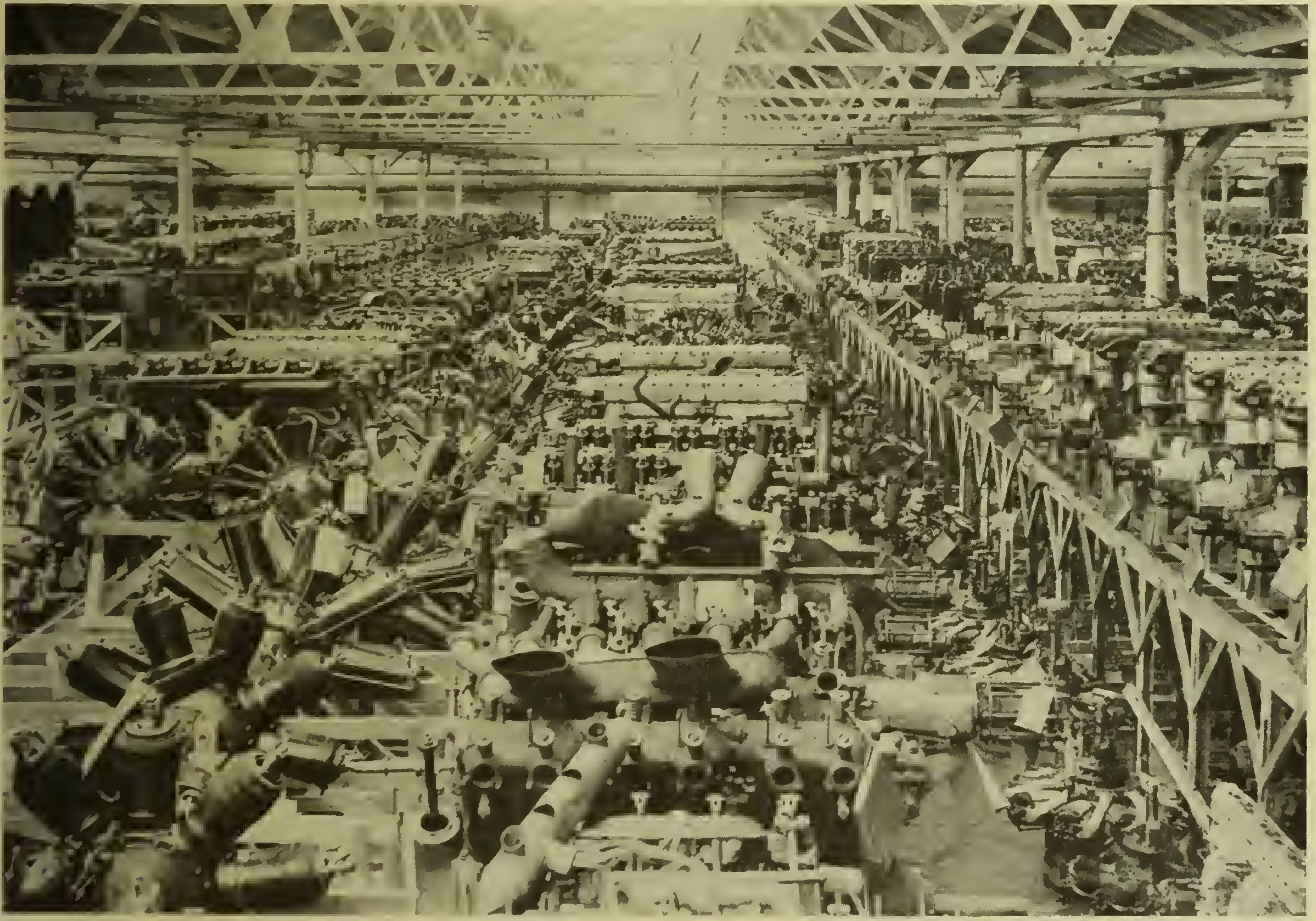
Several installations have been made at the Mitoubishi Mining Co.'s smelters. In the installation at Kamioka the gases passing through the treater come from the following furnaces:—Three lead-smelting blast furnaces, two liquation furnaces, five softening furnaces, and all the lead-refining furnaces and kettles. The Kamioka smelter is located in the heart of the sericulture district, and the residents in the vicinity strenuously objected and demanded heavy indemnities, claiming that the smelter smoke damaged the mulberry leaves and killed the silkworms. Therefore, every effort was made to complete and start the Cottrell plant at an early date. About 1 to 1½ tons of dust are collected per day in a three-section treater.

The treater at the Ikuno smelter handles the gases from two blast furnaces smelting copper ores. After passing through an old dust chamber, the gases are drawn through the treater by an exhaust fan and are discharged from the old stack. At the first trial the treater showed good efficiency, but this lasted only a couple of days, and then the operation became so unsatisfactory that the diminution of smoke could scarcely be recognised even when the treater was charged at a high potential. After experimenting in various ways, it was decided to humidify the gases, a practice which was found necessary for satisfactory precipitation in several American plant. A dozen orchard spray nozzles of 1-16 in. diameter arranged in the dust chamber, using water at 120 lbs. pressure per sq. inch, injected a fine spray into the gases before they entered the treater. Thus precipitation was conspicuously improved and the efficiency raised to about 95 per cent., and at the same time the operator can raise the charging voltage to 80,000 volts while the current is only 30 amp. When, in order to examine the effect upon precipitation, the water sprays are turned off, the charging potential drops and the current increases so that the clearance becomes as low as 50 per cent. The amount of dust precipitated per 24 hours is about 0.6 ton.

GREAT BRITAIN'S DISPOSAL OF AERONAUTICAL MATERIAL.

Quite recently the Aircraft Disposal Company, Limited, was incorporated in London for the disposal of all the surplus aircraft and accessories of the British Government, and the sole managing and selling agents of the new concern are Messrs. Handley Page, Ltd., whose name and machines are so well known in the Far East. The purchase price was, we understand, £1,000,000, in addition to which 50 per cent. of any profits realised by the new company from the sale or other use of the material taken over will accrue to the Government. However, the object rather than the terms of the agreement concerns the Far East. The object is to get as much as possible of surplus British aircraft material disposed of throughout the world in the shortest possible time. In Great Britain's need there is opportunity for the Far East and every country where commercial aviation is developing and where aeronautical material can be turned to account.

A press inspection was recently afforded of one of the aircraft depôts taken over under the new arrangements. This particular depôt is situated at Waddon, near London, and it is only one of six depôts taken over. Moreover, the contents of 130 more stations have to be sorted out and transferred. Yet even at the depôt at Waddon it was difficult to realise or even to visualise the vast amount of material to be handled there. The accompanying illustration of one of the engine stores at Waddon will give some idea of the dimensions of the proposition. The material available includes 10,000 aeroplanes, 30,000 aero engines, £1,000,000 worth of instruments and other accessories and materials in proportionate quantities, much of which is new, and a large proportion in good condition. There are included such things as 1,000 tons of ball bearings, 350,000 sparking plugs, 100,000 magnetos, bolts, nuts, and small accessories which are finding a ready market, and for which a world-wide market exists. From the very large stock of instruments on hand sets for motor-cars are easily made up. Revolution counters can be changed into speedometers, and aneroid barometers for registering height can be changed into ordinary barometers for forecasting weather conditions. Engines for aircraft work run satisfactorily for stationary work at a lower speed, and form efficient light and power plants. There is a very large potential market for such equipment in the Far East.



Some of the Engines for Disposal at the Waddon Depot.

Of course, the main purpose of the Disposal Co. and of Messrs. Handley Page, the sole managing and selling agents, is the disposal of aircraft, and it is towards these problems that attention is mainly directed. It is frequently claimed, and with every justification, that the prestige of British aircraft stands higher to-day than any other in the world. In China this particularly is the case. Every Government who wishes to economise in their organisations for defence must necessarily take lessons from the war and effect savings, by preparedness in the air, in Naval and Military expenditure.

The opportunity to do this is at the present time unrivalled in view of the facilities afforded by the British Government under their surplus material disposal scheme. The machines for disposal are as good to-day as they were when they were turned out from the factory a short while back. These machines can now be purchased at a cost which is only a small proportion of the original cost to the British Government. A country, therefore, inaugurating a National programme in the air can get through the development period at a very low cost owing to these large stocks which are available in Great Britain. Behind these stocks of complete machines are all the necessary adjuncts of spare parts available both for engines and machines, so that there is no fear of their organisation being hampered by the lack of the requisite subsidiary supplies. After these stocks are exhausted it will be impossible to replenish them or obtain material except at three or four times the cost.

Commercial aviation is also steadily developing, and in the Far East the prospects are exceptionally promising. In the minds of experts there is no doubt as to the certainty of air transport occupying a very prominent position in the development of business in the future and projects for inaugurating services of transport by air stand to gain substantially by the facilities mentioned for the purchase of machines and material.

It should be added that Messrs. Handley Page are not tied down to any stereotyped methods of sale or disposal. They can grant such conditions as they think fit as to payment, and, thus favoured, it may be possible to start new enterprises which would not be otherwise possible.

In a speech delivered at the luncheon held after the inspection of the Waddon depôt, Mr. Handley Page dealt with many of the points to which reference has already been made, and stated that whilst it was early to give results of the sale of aircraft by the new company, he could claim that in the short period of their career they had sold many more machines than the Government Disposal Board had during the whole period of its existence.

THE FIRM OF JOHN I. THORNYCROFT AND CO., LTD.

ITS CAREER AND PROSPECTS.

Few names in the engineering industry are better known in the Far East than that of Messrs. John I. Thornycroft and Co., Ltd., more particularly, perhaps, in connection with shipbuilding and marine engineering. In China and the East the firm have supplied a great many craft, one of their tunnel-stern, shallow-draft steamers having been the first vessel to navigate the Yangtsze Gorges and prove the possibility of improvement on the old Chinese methods of navigation of the river. In China, particularly, there is a very great field for the firm's marine motors and small craft generally, quite apart from the market developing for its commercial motor vehicles; and Messrs. Thornycroft's depôt and repair shop at Shanghai is proving of great benefit to users of motors generally. It is not a matter for surprise, hardly even for comment, that the prestige the firm enjoys in other parts of the world should extend throughout Far Eastern territory. In Great Britain few industrial concerns are held in so much respect. This is not only the case with Government and official circles, with whom the nature of the firm's work brings it closely into touch, but is common amongst all users of the firm's products. Such esteem is, perhaps, particularly evident amongst those who have received their training, or some portion of their training, in the company's shops and offices. One runs across quite a host of these good people in the engineering world, and the regard which they place upon their association with Thornycrofts is very telling testimony of the firm's high standing. It was the same in the firm's early days. Long ere the company obtained its present dimensions and prosperity it was never possible legitimately to associate the name of Thornycroft with what was second-rate. Half a century ago its name stood high amongst its contemporaries in marine engineering. With some of the latter the firm was then established in or near London. Far-reaching indeed are the changes and developments which have occurred since that time. Many firms have migrated from London; others, prosperous and substantial then, have long ceased to exist, and only to a few their names are a memory. Yet Messrs. Thornycroft have steadily enhanced their scope and prestige, and to-day stand in the very first rank of British engineering enterprises.

It is not likely that the Far East will fail to avail itself of facilities which Great Brtain has found so invaluable, and in the ordinary course of things a large share of Far Eastern trade will fall into this firm's hands. From the point of view of the Far East it will be well that this should be so, for in placing its requirements with Messrs. Thornycroft it benefits by the highest scientific and mechanical skill and the most ample manufacturing facilities. In these circumstances it will be of interest to present a few facts of the firm's origin, progress and present position, which we are enabled to obtain from a volume Messrs. Thornycroft have just issued, dealing with half a century's progress and five years of war work. This work has been elaborately and artistically produced, and is liberally illustrated with pencil drawings by Fred Taylor, R.I. One or two of the smaller drawings are reproduced with this article, and it is hoped to show others on another occasion.

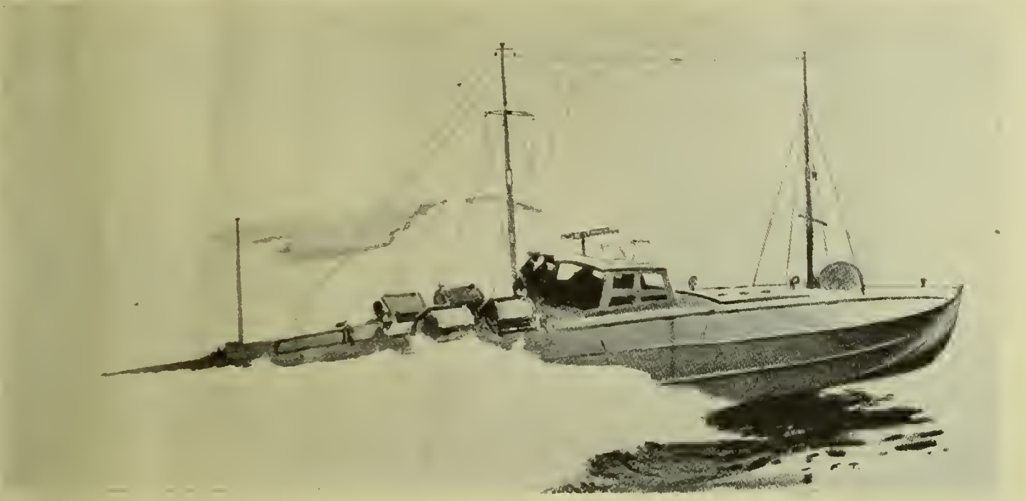
The founder of the firm, Sir John I. Thornycroft, F.R.S., LL.D., is the elder son of the late Thomas Thornycroft, who is known as an eminent sculptor of his day, but who also possessed very marked engineering ability. The early education and training in mechanics that he personally gave his son developed what was, undoubtedly, a great natural aptitude. Sir John I. Thornycroft's brother is the well-known sculptor, Sir Hamo Thornycroft, R.A. After it had been decided that he should take up engineering as a career he went to Glasgow University and became a pupil of Lord Kelvin and Professor Rankin, who occupied the chairs of Natural Philosophy and Engineering. Sir John then spent some time in different shipyards in the North before establishing a yard at Chiswick. His designs of light high-speed boats and machinery at once attracted attention, at first for commercial and then for war purposes both at home and abroad, and the success of certain vessels caused world-wide interest. Eventually, with the invention of the Whitehead torpedo, the business at Chiswick became mainly that of torpedo-boat building. Sir John's brother-in-law, Mr. John Donaldson, became partner in 1872, and the business was continued at Chiswick until 1900, the year of Mr. Donaldson's decease. The business was then turned into a limited company, and a few years later the increasing size of torpedo boats and destroyers rendered it necessary to move from the Thames to Southampton, where the building of large commercial vessels and repair work was also undertaken. In the meantime a separate works had been established at Basingstoke by Sir John and his sons for the manufacture of motor vehicles, since conducted with such conspicuous success. Amongst the most important developments in the firm's manufactures was the employment of the Thornycroft patent water-tube boiler for high-speed craft. Output to date exceeds 2,250,000 h.p. Another invention of importance is the tunnelled form of stern, enabling a screw propeller of greater diameter than the actual draft to be fitted to shallow-draft vessels. The firm played a leading part in the introduction of oil fuel for marine purposes, and the Thornycroft patent burner and oil fuel system has been very widely adopted. The success of the com-

Decoy Ship "Hyderabad."

In this vessel Messrs. Thornycroft embodied their tunnelled stern design, which provides for exceptionally shallow draft enabling a screw propeller to be installed of greater diameter than the actual draft of the vessel. Such a vessel is practically immune from torpedo attack, as a torpedo cannot be set to run with certainty at less than about six feet below the surface. The "Hyderabad" drew 3 ft. 9 in. Despite the number of torpedoes discharged at her she was in existence at the end of the war. Another "Q" ship designed on ordinary lines and commissioned about the same time was torpedoed and lost within twenty-four hours.

pany has been largely attributed to a very thorough knowledge of both mechanical engineering and naval architecture by the heads of the firm. There is no doubt that the best possible results will always be achieved where the closest co-operation exists between the two branches of shipbuilding. The concern which designs and manufactures itself every part of the complete vessel will always produce a better ship than is obtained by purely engineering and shipbuilding firms working individually and carrying out their respective parts.

The great part which Messrs. Thornycroft played in the war is worthily dealt with in the book just published. From the outbreak of hostilities, the period of the war represented a time of very great pressure for the firm—a pressure which steadily increased as labour and materials grew scarcer. In certain instances the Government gave Messrs. Thornycroft practically a free hand in the design and development of their marine work, and abundantly was this policy justified. Over and over again problems of vital importance were submitted to the firm, and as often were efficient solutions forthcoming. Propositions and inventions of the most practical value were freely submitted by the firm to Government and promptly adopted by the latter. Judging by the statements contained in the volume, Messrs. Thornycroft do not appear to have experienced those difficulties in dealing with the Government of which so many firms have complained. In meeting the submarine peril, Messrs. Thornycroft performed work of the very highest importance. The rapid production of their high-power coastal motor-boats is a case in point. The demand for these became so urgent that it was necessary to employ nearly all the firms who had had experience in light boat construction, and as Messrs. Thornycroft had prepared all the designs for the original boats, the Government contracted with them for the whole supply, making them primarily responsible for their production. Another instance was the invention of their improved bomb-throwers for depth charges, which rendered this means of dealing with submarines at least ten times as effective. The employment of the firm's tunnelled stern type of river steamers for decoy-ships, enabling them to be built of such shallow draught as to be practically immune from torpedo attack, proved a thoroughly sound idea, and one upon which enthusiastic praise has been bestowed. In their manufacture of motor vehicles for war purposes, the firm adopted a far-sighted policy, and their vehicles proved amongst the very cheapest and most efficient in service. The company's war-time output comprised, for destroyers and flotilla leaders, 29 vessels aggregating 37,210 tons and 957,000 i.h.p. Submarines and engines for submarines reached a total of 14,900 i.h.p. Eleven other vessels were constructed, totalling 5,318 tons and 7,800 i.h.p.



Coastal Motor Boat carrying Depth Charges.

Some 316 costal motor-boats, patrol-boats, etc., were built or supplied by licensees to Messrs. Thornycroft's designs. Five thousand motor vehicles were constructed for the Government, and over three thousand depth charge-throwers.

H.M.S. "Spencer," the Flotilia Leader of the famous Harwich Force. Built and engined by Messrs. Thornycroft.

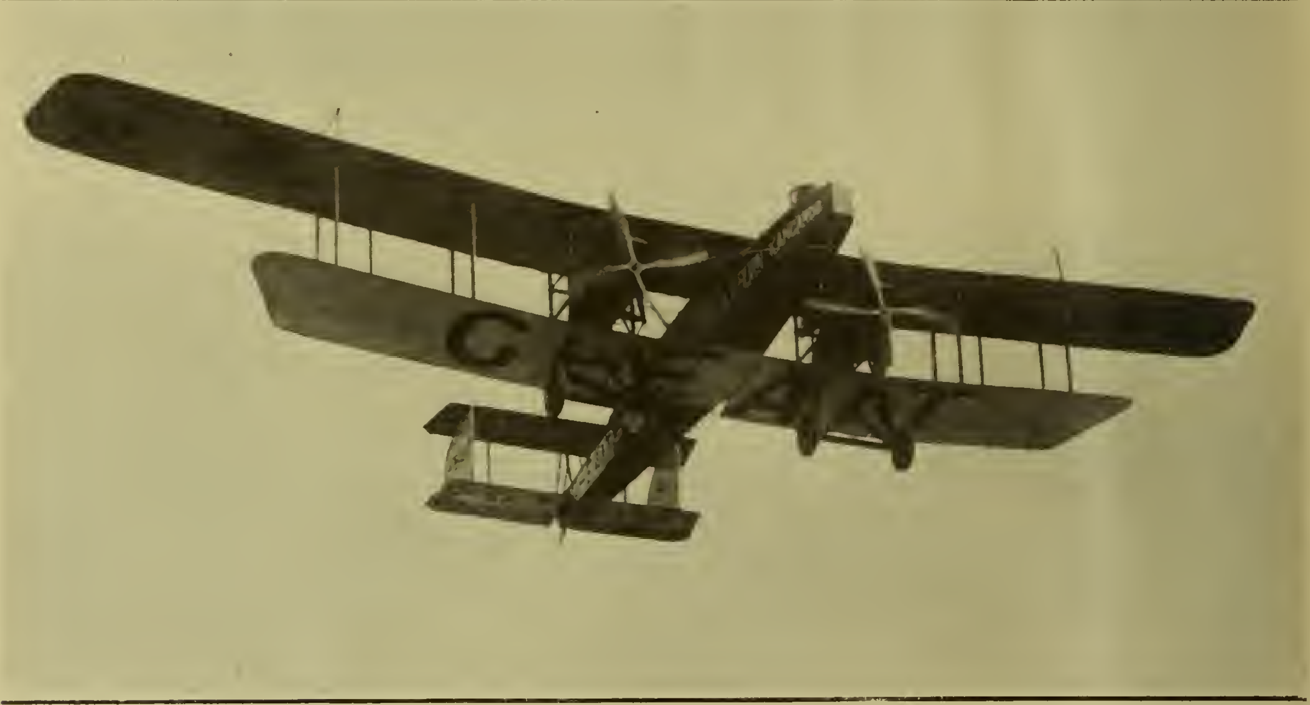
On their return to peace-time conditions, Messrs. Thornycroft are in a very satisfactory position, as during the war they have not suffered the disorganisation which has taken place in many businesses by changing over to produce something quite different from their regular work. They are now exceptionally well placed for undertaking the construction of merchant vessels up to 5-6,000 tons deadweight capacity. Whilst they have specialised on destroyer construction, they are not now relying on war work, but are undertaking the supply of all types of commercial craft from high-class channel service steamers to boats in sections to be shipped for re-erection on foreign rivers. They will also maintain a large output of motor vehicles, marine and stationary motors, motor-boats and other engineering productions. The reputation of the firm never stood higher than to-day nor its manufacturing facilities more complete or so well organised. In catering for overseas trade its policy is towards establishing its own organisations and workshops abroad, and it is thus adopting the best conceivable method for attaining success in foreign markets.

AN EFFICIENT TYPE OF BRITISH COMMERCIAL AEROPLANE.

A prize of £10,000 has been offered in London for the first return journey by air between England and India, carried out under commercial conditions; and the Blackburn Aeroplane and Motor Co., Ltd., of Leeds, notify us of their intention to compete with one of their standard Rolls-Royce, twin-engined, single-fuselage "Kangaroo" aeroplanes. This firm has been good enough to supply us with a detailed description of this type of machine. The particulars here given will prove of interest to the Far East as being indicative of what is best in British practice in commercial aviation, and showing some of the most recent improvements in commercial aeroplanes of British manufacture.

As already mentioned, the engines fitted are twin Rolls-Royce "Falcon" type, each of 240 h.p. Extra large radiators are being fitted to cope with tropical conditions. The fuel supply system is non-standard, extra tankage being provided to allow of non-stops over long stages when necessary. The whole of the piping in the fuel system is of the flexible metal type, guarding against leakage due to vibration or landing shock.

The considerable cargo demanded by the competition conditions will be borne largely, if not entirely, in the form of spare parts, thus rendering the flying party independent of outside help to a high degree. It might be argued that this is not a true commercial load, but, of course, any regular service along the route in question would necessitate a series of stations supplied with spare parts, thus rendering the cargo capacity available for merchandise. This load will be carried partly in the holds normally allocated to cargo on the standard machine and partly in new holds, replacing some of the normal cockpit accommodation.



The "Kangaroo" twin-engined single-fuselage Aeroplane, by the Blackburn Aeroplane and Motor Co., Ltd.

Large size tyres are fitted suitable for landing on sandy country, and the chassis is exceptionally well sprung.

In this type of machine the engines are accommodated in streamline nascelles 15 ft. apart on either side of the central fuselage, the airscrews being opposite handed. The mountings are of steel tube throughout, and are independent structures attached to the planes by pin joints. Thus they are readily interchangeable or replaceable by mountings for other engines. Sockets fitted in the forward extensions of the engine bearers carry standard honeycomb radiators.

The tail unit is of the biplane type, the twin fins and rudders being situated between the planes. This arrangement of the tail not only lends itself to the construction of a compact unit, but is also very efficient from the point of view of stability. A pilot can fly the machine for exceptionally long periods with both hands and feet off the controls, and the disposition of the tail surface is such that, in the event of one engine failing, the machine automatically corrects itself for directional control.

The main plane spars are of channelled spruce, and the ribs of three ply with spruce flanges. The main plane fittings are of sheet steel. The gap struts are steel tubes faired with veneer and they are fitted with machined steel fork sockets, which are attached to the main plane fittings by pins in a plane parallel to the spar. The folding arrangement of the plane comprises robust hinge fittings machined from solid steel forgings, and the trailing edge "fan" is of special design.

The fuselage structure consists of spruce longerons and struts braced with tie rods. The tail skid operates from the rudder box, but is at liberty to swivel.

Particulars as to dimensions and performance of this type of machine show :—

Climb—9¼ minutes to 5,000 ft.
Ceiling—13,500 ft.
Weight—8,500 lbs.
Span—74 ft. 10¼ in. spread; 27 ft. 9½ in. folded.
Length—44 ft. 2 in. spread; 46 ft. folded.
Height—15 ft. 9 in.
Propellers—4-bladed, 9 ft. 10 in. diameter.
Wheel track of each chassis—5 ft.; between centre lines of chassis, 15 ft.
Top speed—89 knots.
Landing speed—43 knots.

As regards the previous history of the "Kangaroo," it may be stated that the type was originally developed during the War for use on North Sea patrols in search of submarines, and achieved considerable success in this duty. It need hardly be said that long oversea journeys of this type in all weathers proved an excellent test of reliability and robust construction. The commercial machines have had a number of successes more recently. A gold medal was won at the Dutch Aero Show last autumn, together with substantial monetary success in passenger carrying. Two machines were selected for long range mail journeys (London to Glasgow) during the September railway strike, and another entered for and made a good attempt in the 1919 flight to Australia, reaching Crete. Another machine has been selected to accompany Mr. Cope's expedition to the South Polar regions, it being destined for duty on aerial photography. Recently the North Sea Aerial and General Transport, Ltd., have been successfully operating a small fleet between Yorkshire and Holland, acting as cargo carriers.

It should be added that the competition flight to India and back, for which the "Kangaroo" machine is entered, is open to aeroplanes, seaplanes, or airships, and is not restricted to craft or crews of British nationality. A considerable cargo is to be carried throughout the journey. Severe time limits are imposed on :—(1) The time taken for either of the two flights; (2) the time of delay between arrival in and departure from India, and the whole flight is to be carried out between May 1 and October 31.

The Chinese Engineering and Mining Co. has declared an interim dividend of 10 per cent. A year ago 5 per cent. was paid.

VEGETABLE-OIL PRODUCTS AND INDUSTRY IN BURMAH.

BY CONSUL L. P. BRIGGS.

The oil-bearing seeds and nuts and other oil-yielding material produced in Burmah include, in the order of their importance, pea-nuts, sesamum, and cottonseed. The others are of little importance.

There are no reliable statistics showing the amount of each kind of oil-yielding material produced in Burmah, but an idea may be obtained from the acreage planted which has been as follows during each of the past five years (according to the Annual Season and Crop Report of Burmah):

Seeds.	Year ended March 31—				
	1915.	1916.	1917.	1918.	1919.
	Acres.	Acres.	Acres.	Acres.	Acres.
Sesamum ...	1,211,000	1,201,000	1,217,000	1,091,000	1,267,000
Peanuts ...	273,000	262,000	261,000	249,000	249,000
Other oilseeds	4,000	4,000	4,000	4,000	4,000
Cotton ...	291,000	187,000	233,000	247,000	372,000

PRODUCTION OF OILSEEDS—SESAMUM AND PEANUT OIL CONSUMED BY NATIVES.

The estimated annual output of peanuts during period 1915-1919, according to the final forecasts published each year in the supplement to the Burmah Gazette, is about 95,000 tons; that of sesamum is about the same. Adding cottonseed and other oilseeds, the total annual production of Burmah during this period was probably nearly 200,000 tons per year. During the same period imports of oilseeds exceeded exports by about 10,000 tons per year.

Practically all the oilseeds produced in Burmah result from cultivation. About one-third or one-fourth of the crop—50,000 or 60,000 tons—is marketed annually.

The oil-mills run principally on peanuts. Most of the sesamum and a great deal of the peanut oil is manufactured and consumed by the cultivators. It is used principally as human and animal food. The peanuts and cottonseed are practically all harvested. Some of the sesamum seed is not extracted.

MARKETING RAW MATERIALS STORAGE AND TRANSPORTATION.

There is no systematic preparation or grading of raw materials prior to marketing. Raw materials are generally handled in gunny bags, 52 by 33 inches.

The raw products are usually purchased of the cultivators by Chinese produce dealers, and by them sold to brokers acting in connections with the mills. The oil is generally marketed as above stated. Brokerage is about one-half of 1 per cent. of the value. Most of the brokers and Chinese dealers have godowns where they store their own purchases. Transportation is almost entirely by Irrawaddy Flotilla Co.'s steamers. The cost varies with conditions. This company publishes no freight-rate schedule.

Peanuts are a fairly profitable crop; especially has this been so since the close of the war, when the oil cake has been marketable. Sesamum seed to some degree, and cottonseed almost entirely, are by-products of the cultivation of plants for other purposes.

CRUSHING OF RAW MATERIALS—NUMBER OF MILLS—QUALITY OF PEANUT OIL.

The oil-bearing materials handled or crushed are mostly peanuts, but partly sesamum and cottonseed. These oil mills get their raw materials from Burmah.

The number of oil mills in Burmah operating in 1918 under the Indian Factories Act—according to a statement of the factory inspector—was 24. These mills are operated in connection with cotton mills and employ cottonseeds and peanuts. Smaller mills produce peanut oil only. Still other small mills use til or sesamum as raw materials. The larger mills of Upper Burmah generally employ square, hydraulic presses.

A chemical test of the peanut oil produced by Jamal's Cotton & Produce Co. is said to have given the following results:

Specific gravity at 60° F.	0.918
Solidifying point, degrees centigrade ...	3.3
Saponification value	196.8
Iodine value	83.86
Reichert Meissl value for 5 grains of oil ...	.3
Butyro-refractometer test at 25° C.	62.75
Free fatty acids	7.55

Chemical analyses are made by the larger mills of both raw materials and products.

VEGETABLE-OIL PRODUCTION—FUEL USED IN THE MILLS.

The annual production of vegetable oils in Burmah (which has varied little since 1913) is about 60,000 tons, or 16,000,000 gallons; that of oil cake is about 50,000 tons. The yield of oil per ton of raw material crushed is about 30 per cent.; that of oil cake 60 to 65 per cent.

In lower Burmah paddy husks are generally used as fuel. The cost is nothing or negligible. In Upper Burmah (*i.e.*, Myingyan, Pakokku, Mandalay) wood is generally used. It costs about 5 rupees per ton. There has been practically no change in the cost of wood since 1913, excepting that resulting from the rise in the value of the rupee.

HOURS OF LABOUR—NUMBER OF EMPLOYEES—WAGES.

There is no regularity of working hours. The mills generally run 10 or 12 hours a day with one shift. In busy periods the larger mills employ a night shift also. The larger mills run practically all the time.

The annual reports of the factory inspector, Burmah, for the years 1913-1918 give the average daily number of employees for the 15 principal factories (not including, however, those large factories operated in connection with cotton ginning and pressing mills) as follows: 1913, 731; 1914, 540; 1915, 603; 1916, 638; 1917, 676; 1918, 697. The factories omitted from the above-mentioned reports would probably bring the total number of employees to at least 1,000 per year. The wages of the employees of these mills probably do not average more than 8 annas ($0.16 to $0.20) per day.

Most of the vegetable oil and a large proportion of the oil cake produced in Burmah are consumed locally. All the vegetable oil and oil cake produced in Burmah is shipped from Rangoon. A fair proportion is produced in that city and vicinity. The balance is brought down by the vessels of the Irrawaddy Flotilla Co. from 100 to 500 miles. Practically all the oil and cake is exported by the large mill owners. Nearly all the oil and cake in Rangoon is stored by the owner, who is also the producer.

The general effect of the war on the industry has been very small. Some new markets have been opened, but as yet there are no definite plans for readjustment.

VEGETABLE-OIL INDUSTRY IN NORTH MANCHURIA.

Soya beans and hempseed are the only oil-bearing materials produced in commercial quantities in North Manchuria. The annual yield of soya beans is given at about 800,000 tons, whilst the production of hempseed averages about 20,000 tons per annum. All but some 10 per cent. of the production is taken by the oil mills.

In North Manchuria only the soya bean is crushed for oil to any commercial extent. A small quantity of hempseed is used, but this is not of much importance. The oil mills in North Manchuria draw their supplies of raw materials solely from the Harbin district. No raw materials are imported. An American Consular report from Harbin gives the number of oil mills operating in that district as 25, owned by Chinese with one exception. The mills have met with great success, and their profits in 1918 and the first part of 1919 were large. The war has had the effect of greatly increasing the bean-oil industry in North Manchuria. In 1918 and the first half of 1919 all of the mills are said to have earned handsome profits. It should be pointed out, however, that the Chinese Eastern Railway, in order to encourage the oil industry along its line, gives preference to oil shippers as against shippers of beans—that is, in the supplying of cars, which are always scarce, the oil dealers have preference over bean shippers. This has had the effect of stimulating the oil industry in the district. It is generally understood that labour and other charges are higher here than in South Manchuria; and were this preferential treatment on the part of the railway removed it is probable that the oil industry would not prove quite so profitable as it is at present. But in spite of these difficulties and the difficulties of currency, the industry has a promising future, and the indications are that it will continue to increase from year to year in importance and extent.

With the exception of the single foreign-owned mill (a British concern controlled by Russians, which has modern machinery), the oil mills use only hand presses, and their machinery is far from modern. The beans are first heated and then passed through grinders. The meal is steamed, and is then ready for the press. The cakes are formed by placing the meal in grass, which in turn is confined in a sort of hoop. The grass is folded over and the entire mass is slipped into the press. The hoop is removed and the press closed down. The grass prevents the meal from escaping, as the press is tightened and allows the oil to ooze out. When the cake is taken out of the press the grass is removed. The average weight of these cakes is 63.2 pounds. The machinery in use in these mills is solely of English and German manufacture, the presses being worked by hand. A fair average quality of oil is produced.

Since 1918 six new mills have been erected and have begun operations; several more are in process of construction and, in addition, a large mill to be equipped with modern machinery is being planned by certain Chinese interests. No mills have been abandoned in recent years.

There are no plans for readjustment further than the building of new mills with rather more modern machinery than is at present in use. It is possible that in the course of another year Harbin may see the erection of a modern mill employing the extraction process, but this is not yet assured. With such readjustment it would appear that production will be steadily increased.

MINERAL OUTPUT OF THE HOKKAIDO, 1917–1919.

The following statistics show the output of minerals in the Hokkaido in the years 1917 to 1919:—

		1919.	1918.	1917
Gold	Momme	71,284	14,427	17,488
Silver	Momme	819,265	616,468	861,928
Copper	Kin	2,204,094	2,152,030	2,511,674
Copper ore	Kan	—	66,270	79,977
Pig iron	Ton	5,270	1,064	—
Quicksilver	Kin	1,050	4,270	3,671
Zinc ore	Ton	1,739	4,477	4,861
Lead ore	Kan	—	483,591	269,051
Iron ore	Ton	137,000	91,234	37,250
Cromium iron ore ...	Kan	186,700	353,383	339,237
Petroleum	Koku	7,851	7,571	5,762
Coal	Ton	4,650,000	4,135,561	3,614.640
Manganese	Kan	1,627,800	2,208,969	2,125,531
Sulphur (crude) ...	Ton	31,020	37,801	66,337
Sulphur ore... ...	Ton	12,300	19,416	12,311
Gold Dust	Momme	430	4,515	11,218
Platinum	Momme	1,300	420	1,055

The output figures for 1919 are estimated.
1 momme=·1325 oz. or 3.7565 grammes.
1 kin=160 momme=21·16436 oz.
1 kan=1000 momme=132·2 oz.
1 koku=39·7 gallons.

The Government Electrical Engineer, Kuala Lumpur, Federated Malay States, will be glad to receive lists of electric lifts, washing machines, irons, vacuum cleaners, and fittings suitable for a large hospital; also of current limiters of small sizes.

Dorman, Long & Co. Ltd., the structural engineers of Middlesborough-on-Tees, have declared a dividend of 4 per cent. free of tax on the Ordinary shares for the half year ended March 31.

SUGGESTIONS FOR AVOIDING DELAYS DUE TO FAULTY MARKING OR SHIPPING.

A firm in Yokohama has evolved a method of avoiding complications and delays due to faulty marking, shipping methods, or other such causes, which may offer welcome suggestions to other foreign traders. To each order they attach copies of a printed form, on which appear the following instructions, divided into two groups. (1) Compulsory: Invoice in quadruple, signed, and at least one copy on substantial paper. Typewritten invoices are preferred to hand written. Consular certificate or origin is required for soap, talcums, tooth powders, pastes, olive oil, and all perfumed articles. Insure against all risks, including pilferage and breakage. Distinctly mark on the policy that inspection of breakage, etc., can be carried on in our own warehouses. The insurance policy must be made payable to our agent in Yokohama. A distinct number must be affixed to each case or strap. Cases exceeding $500 gold per freight ton of measurement must be especially declared on the bill of lading and freight paid to correspond. (2) Desirable: Send one copy of the invoice ahead or some other means of indicating what goods are being shipped immediately. Goods to be packed, whenever possible, according to the classification of this indent, to save time at customs assessment. An entirely separate sheet of invoice is desirable for each case, so that more than one customs officer can work on the shipment simultaneously. The gross weights of each item is desirable on the invoice, to facilitate the assessment of duties that are calculated by weight. Discounts should be taken off each individual item before carrying it out. Customs frequently ignore discounts appearing at foot of invoice, and this materially affects the sum paid as duty where heavy amounts *ad valorem* are to be paid.

INDUSTRIAL RESEARCH IN GREAT BRITAIN.

The following are some of the Research Associations which have been approved by the Department of Scientific and Industrial Research as complying with the conditions laid down in the Government scheme for the encouragement of industrial research, and have received licences from the Board of Trade under Section 20 of the Companies' (Consolidation) Act of 1908:—The British Iron Manufacturers' Research Association (Atlantic Chambers,

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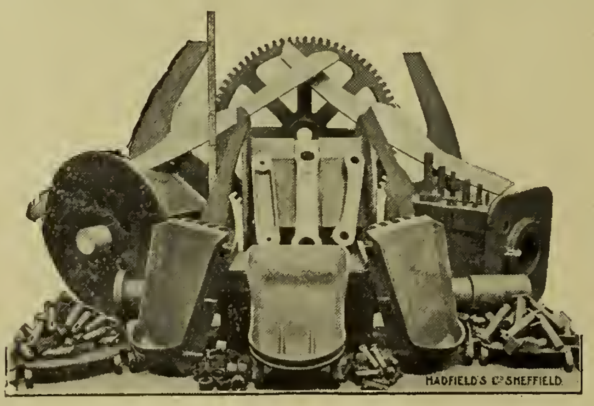

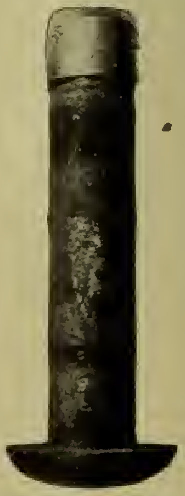

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Brazennose Street, Manchester); the British Portland Cement Research Association (6, Lloyd's Avenue, London, E.C.3); and the British Non-Ferrous Metals Research Association (29, Paradise Street, Birmingham). The British Refractory Materials Research Association and the Scottish Shale Oil Research Association have been approved by the Department, but not yet licensed by the Board of Trade. The memorandum and articles of association of the British Electrical and Allied Industries Research Association are under consideration, while the Users of Liquid Fuels are engaged in preparing their memorandum and articles of association.

BOOKS.

THE THEORY AND PRACTICE OF AEROPLANE DESIGN.

By S. T. G. Andrews, B.Sc., and S. F. Benson, B.Sc. London: Chapman & Hall, Ltd. 15s. 6d. net.

This book is one of the "Directly-Useful Technical Series" intended to occupy a position midway between theory and practice, and the present volume will be found of use to designers, draughtsmen and students. It also has much of interest to the general reader. Care has been devoted throughout to the preparation and production of diagrams and tables. A special feature has also been made of illustrative examples, a large number of which are included. The subject has been presented in a complete and logical manner, and the principles enunciated have been applied to the lay-out of a complete machine. The authors have had valuable assistance in arranging their work, and they have provided a reliable text book, the need for which has long been recognised. Of course, the qualifications of the aeronautical engineer and design include a good knowledge of mathematics and physics; of the graphic representation of laws, of the fundamental theorems in theoretical mechanics, and various theorems in applied mechanics, and the real value of the work as a text book is for those possessing such knowledge. The book comprises chapters on the principles and materials of design; the properties of aerofoils; stresses and strains in aeroplane construction; design of wings, fuselage, chassis and airscrew and control surfaces; stability and performance. Special importance will attach to Chapter XIII., which embodies the application of the principles advanced in preceding sections. The general trend of aeroplane design is treated at some length in the final chapter, and the work is well illustrated.

STEAM BOILER CONSTRUCTION.

By Edward G. Hiller, M.Inst.C.E., Manchester.—The National Boiler & General Insurance Co., Ltd. 3s. 6d. net, or bound full cloth, 5s. net.

The little work comprises the rules of the National Boiler and General Insurance Co. with notes on material, construction and design of steam boilers and similar vessels. Its contents are of the most practical nature, and are based on the experience of the National Co., of which the author is the chief engineer, and on experiments by various authorities. Whilst the book is particularly useful for designing boilers intended to satisfy the requirements of the Insurance Co., it will be found of value wherever knowledge is sought as to efficient design and construction of steam boilers for land purposes. Chapters are given on the testing of materials, external shells, riveting and welding. Openings in shells. Flat and cambered ends. Furnace and flue tubes for horizontal boilers. Separate chapters are also given to the various types of boilers, including marine dry-back and water-tube; also to the subjects of hydraulic tests, boiler fittings and setting. For the purpose of the present, the second edition, new sections dealing with steam pipes and superheaters have been added, and the whole of the notes have been revised. The book is well illustrated and indexed.

PERSONALIA.

Mr. J. A. Brodie has been elected president of the Institution of Civil Engineers, with Mr. W. B. Worthington, Dr. W. H. Maw, Mr. C. L. Morgan, and Mr. B. Mott as vice-presidents. Other members of the council are Mr. E. A. S. Bell, Dr. C. C. Carpenter, Colonel R. E. B. Crompton, Mr. M. Deacon, Sir Archibald Denny, Bart., Sir William H. Ellis, Mr. A. Gordon, Mr. W. W. Grierson, Sir Robert A. Hadfield, Bart., Sir Brodie H. Henderson, Mr. E. P. Hill, Mr. G. W. Humphreys, Mr. Summers Hunter, Mr. H. G. Kelley, Mr. C. R. S. Kirkpatrick, Mr. J. Marchbanks, Mr. H. H. G. Mitchell, Engr. Vice-Admiral Sir Henry J. Oram, Mr. F. Palmer, Captain H. Riall Sankey, Sir John F. C. Snell, Mr. W. A. P. Tait, Mr. A. M. Tippett, Mr. E. F. C. Trench, Prof. W. H. Warren,

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  - Coal Tar Creosote
  - Essential
  - Fuel
  - Fusel
  - Fish
  - Gas
  - Green
  - Lubricating
  - Paraffin
  - Petroleum
- Oils: Whale
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- Pitches
- Red Lead
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and Sir Alfred F. Yarrow, Bart. This Council will take office on the first Tuesday in November, 1920.

Dr. J. H. Andrew has been appointed to the Chair of Metallurgy in the Royal Technical College, Glasgow, vacant by the transfer of Dr. Desch to the University of Sheffield. Since June, 1914, he has been chief of the metallurgical research department of Sir W. G. Armstrong, Whitworth & Co., Ltd., Manchester.

Mr. W. G. Gray has resigned his appointments of commercial manager and director of James Dunlop & Co., Ltd., and has become manager director of the Steel Company of Scotland, Ltd.

Mr. A. Bonnin has been elected chairman of the Wallsend Slipway and Engineering Co., Ltd., and Mr. W. B. Pickering, of Hadfields, Ltd., has been elected to a seat on the board.

The late Mr. Claud Hamilton, managing director of Claud Hamilton, Ltd., engineers, Glasgow, left personal estate of the value of £203,491

The late Mr. R. J. Wales, joint assistant managing director of T. W. Ward, Ltd., the well-known Sheffield firm, left estate valued at £26,251.

The late Mr. R. N. Jackson, chairman of P. R. Jackson & Co., Ltd., of Salford, left £128,330 gross and £93,178 net personalty.

The gross value of the estate of the late Mr. J. R. Nisbet, managing director of the Bowden Wire, Limited, is £21,219.

The death took place last month of Mr. J. Metcalfe, a director of Davies & Metcalfe, Ltd., Romiley, near Manchester.

The late Sir John Jackson, the well-known contractor, left £504,764 net personalty.

TRADE NOTES.

The accounts of Beyer, Peacock & Co., Ltd., the locomotive manufacturers, of Manchester, show profit for four years ended Dec. 31, 1919, £309,664; brought forward from 1915, £6,581; amount transferred to reserve, £20,000; preference dividend for 3½ years, £57,750; ordinary dividend, 10 per cent. for three years, £60,000; available, £178,495; final preference dividend paid January, 1920; ordinary dividend, 10 per cent., for year 1919, £20,000; depreciation of Government securities, etc., £10,000; reserve account, £30,000; carried forward, £110,245. The directors have under consideration a scheme for the extension of the works buildings, and a new boiler shop is at the present time in course of erection. Additional expenditure will thus be required for new machinery, and further working capital will be needed. The directors, therefore, in order to provide for these and possible future requirements, have decided to recommend that the authorised capital be increased by £800,000. It is also proposed to alter the articles of association so as to permit of the capitalisation of undivided profits.

Fellows Magneto Co., Ltd., of London, announce a dividend of 25 per cent. on the ordinary shares, against 24 per cent. The preference shares receive a participating dividend of 1½ per cent., making a total of 9½ per cent. for the year, the same as for last year. The company was formed as a direct outcome of the war and the withdrawal of German-made magnetos from the market.

The report of Johnson & Phillips, Ltd., the electrical engineers, of London, shows maintenance of buildings, plant, etc., £27,000; profits, £89,964; brought forward, £20,510; depreciation, £12,198; income-tax and excess profits duty, £16,375; dividend, 12½ per cent., less tax; carry forward, £33,170.

Sir Robert Horne, President of the Board of Trade, replying to a memorandum from the exhibitors of the recent British Industries Fair, states that ever since 1915 the support given by manufacturers had steadily increased, and the Fair may now be regarded as permanent.

Amongst the returns of new companies officially issued appears the name of Brooks & Doxey (1920), Ltd. Capital £1,000,000 in £1 shares. Registered office: Union Iron Works, West Gorton, Manchester.

The directors of the English Electric Co., Ltd., recommend a dividend of 8 per cent., less tax, on the ordinary shares for 1919, carrying forward £45,302.

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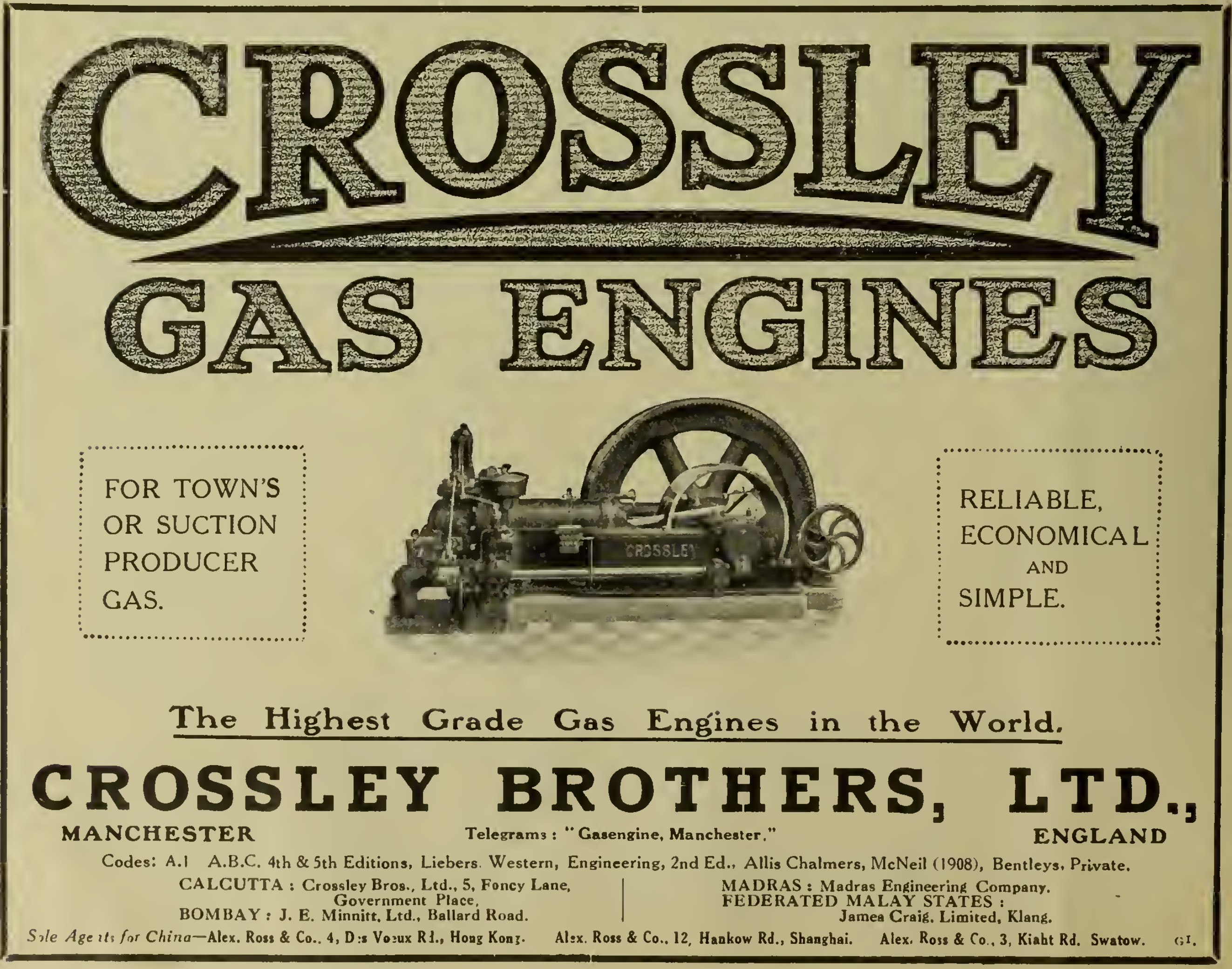

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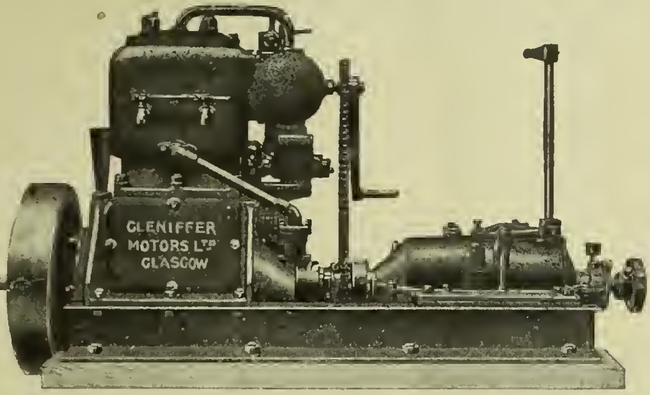

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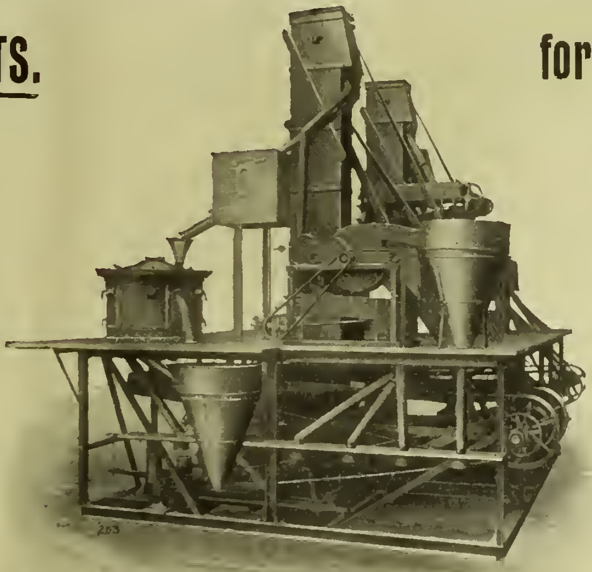

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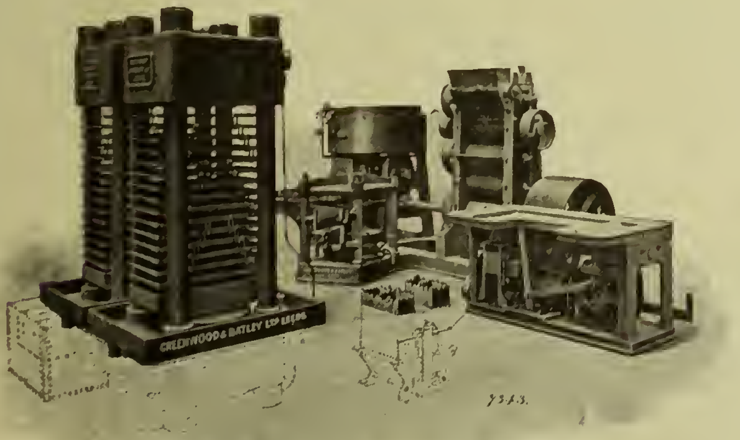

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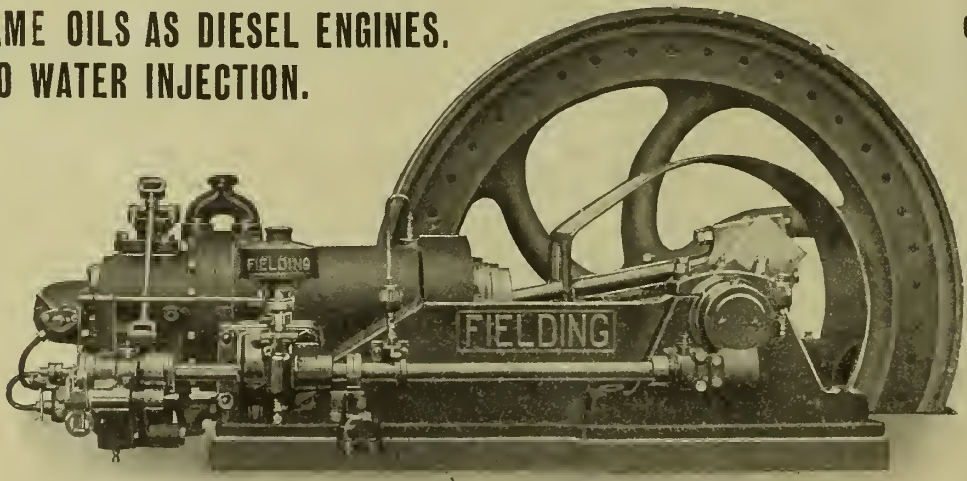

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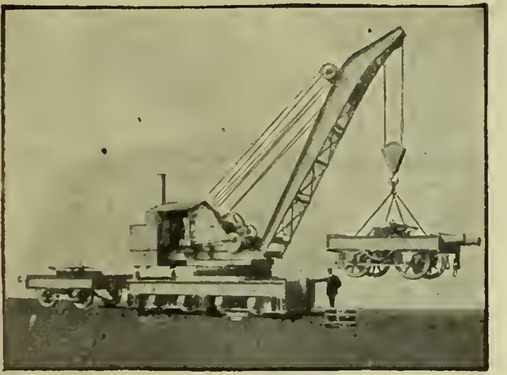

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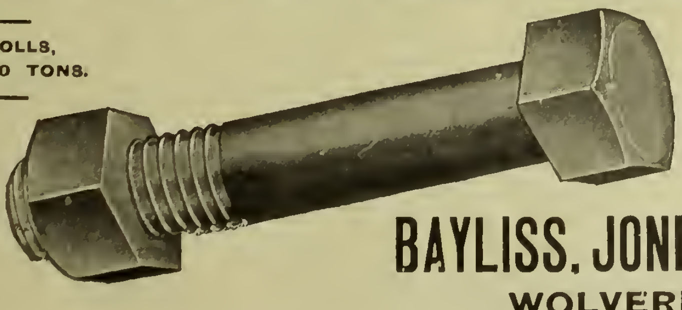

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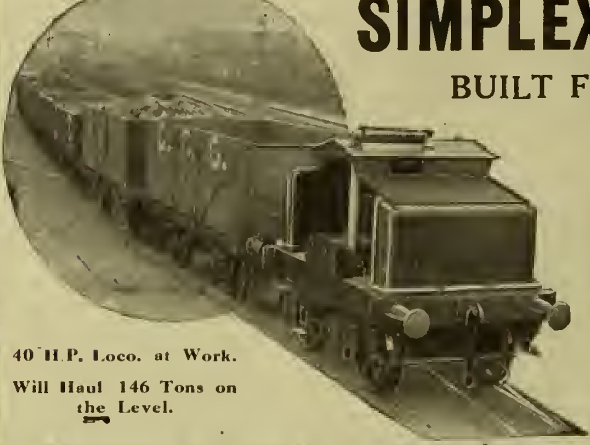

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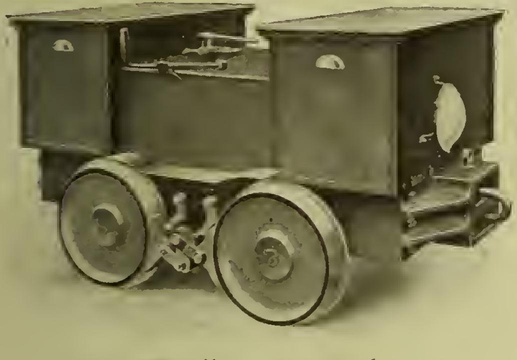

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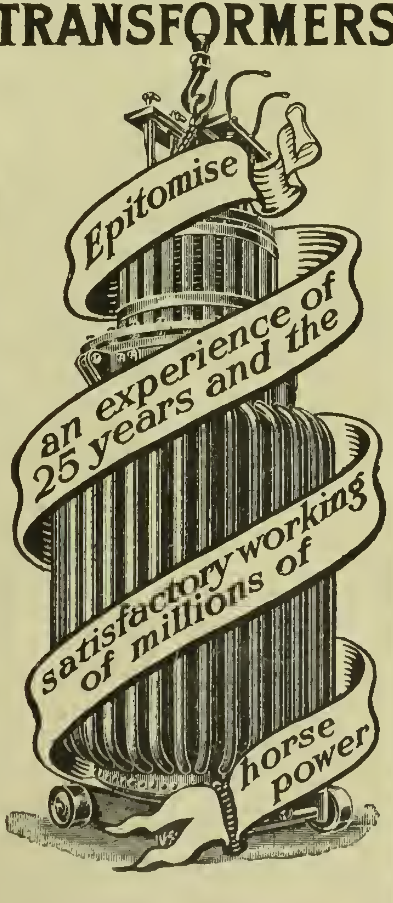

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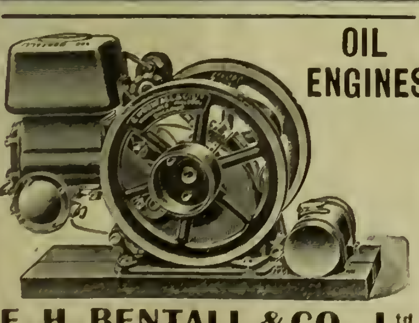

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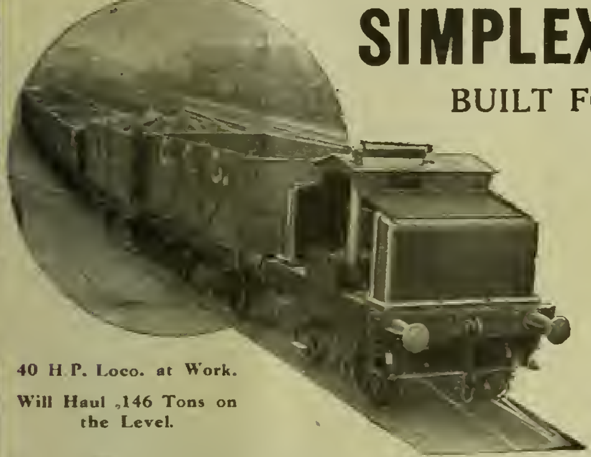

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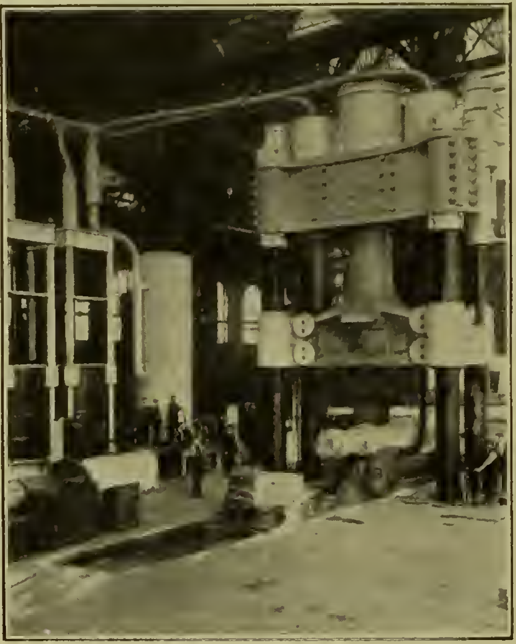

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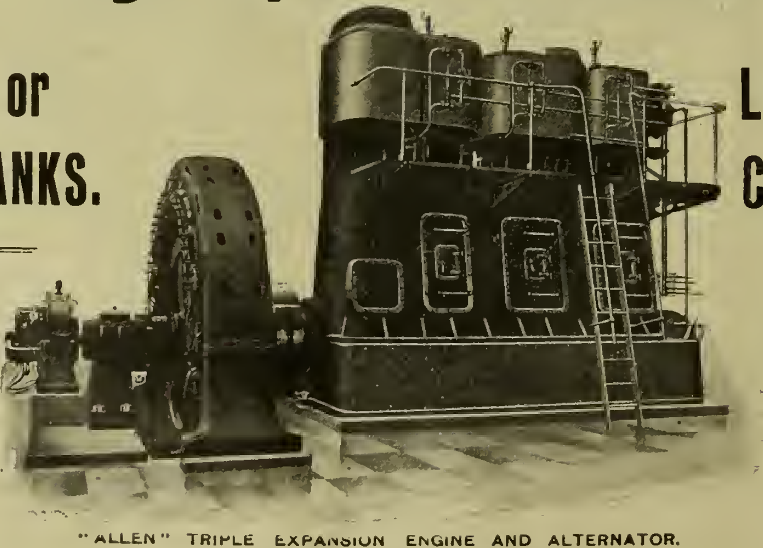

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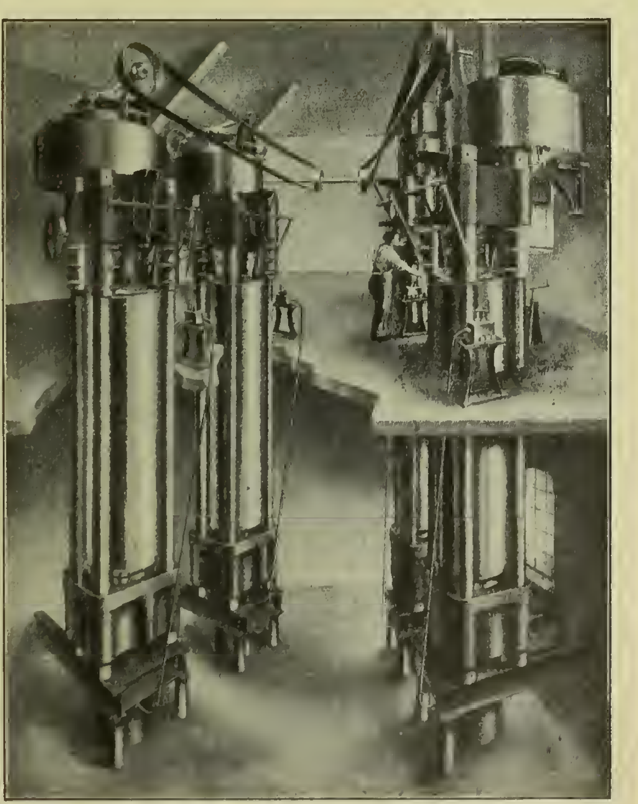

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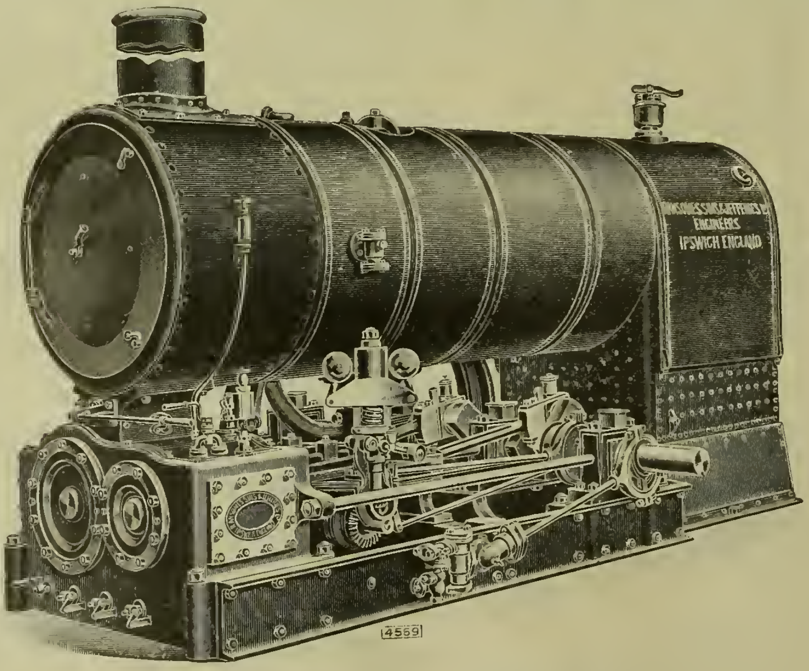

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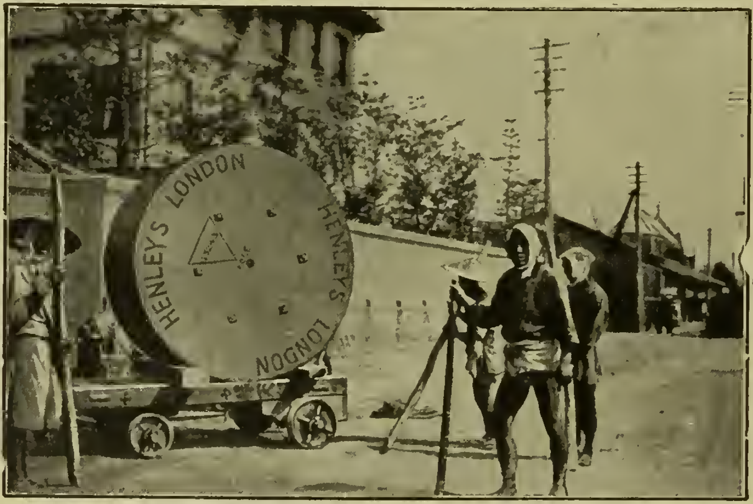

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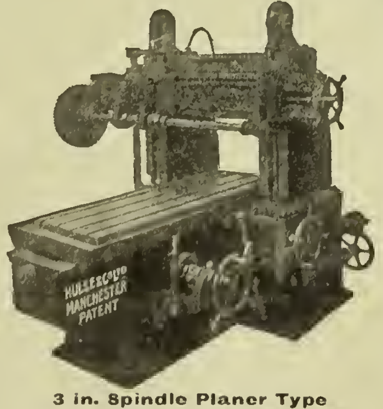

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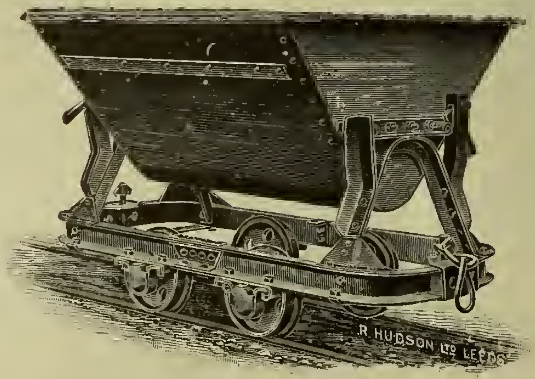

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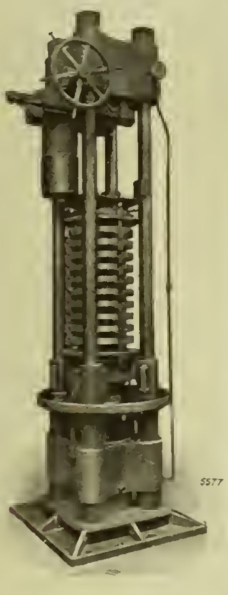

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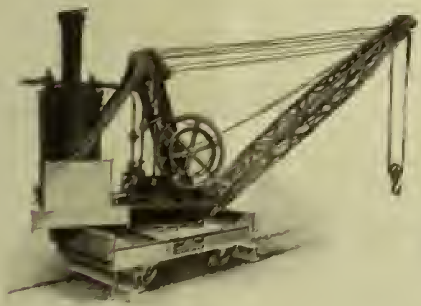

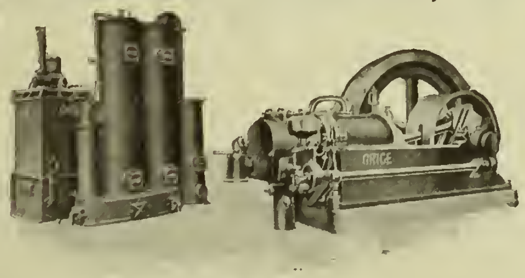

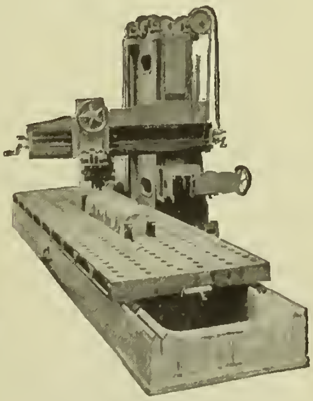

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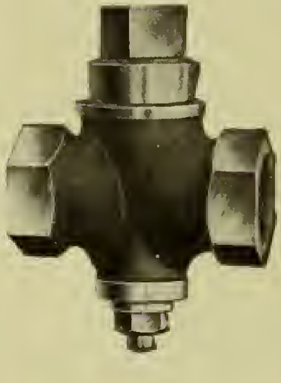
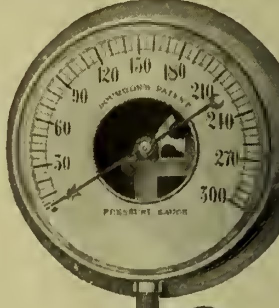

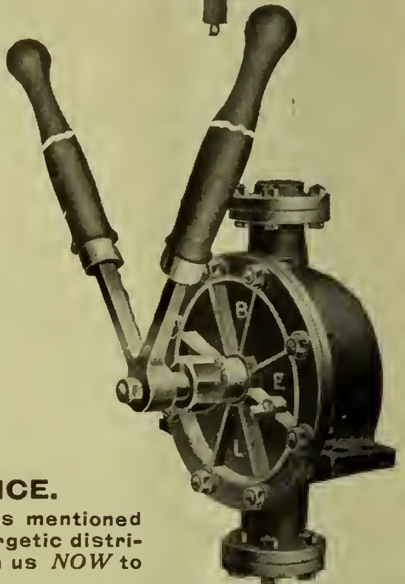

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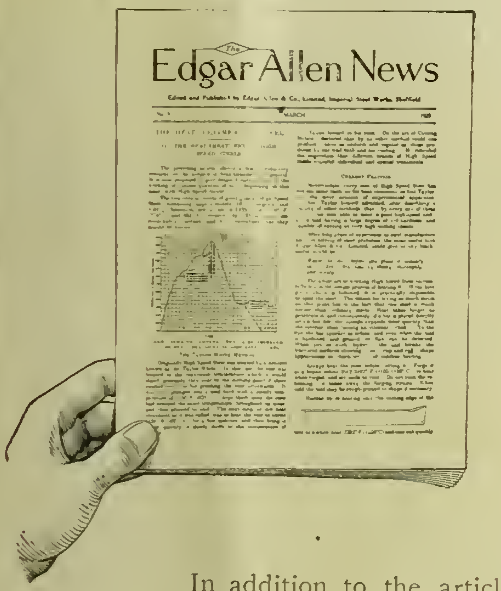

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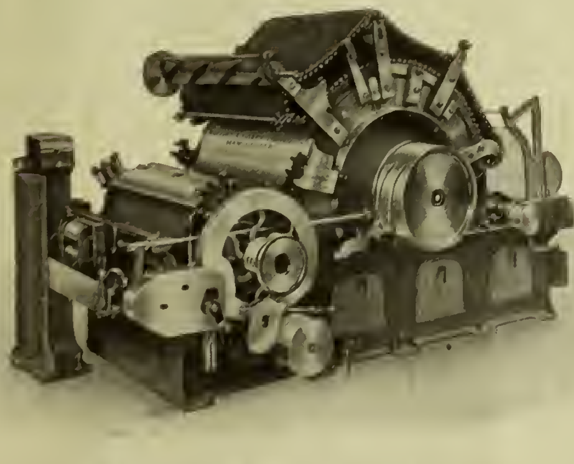

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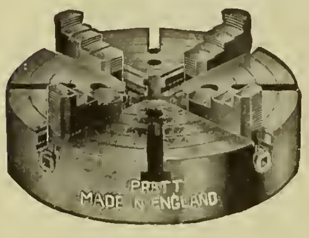

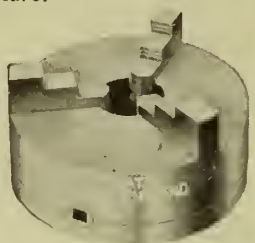

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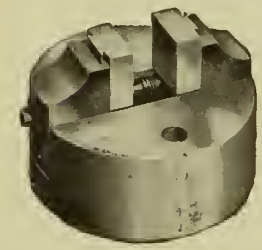

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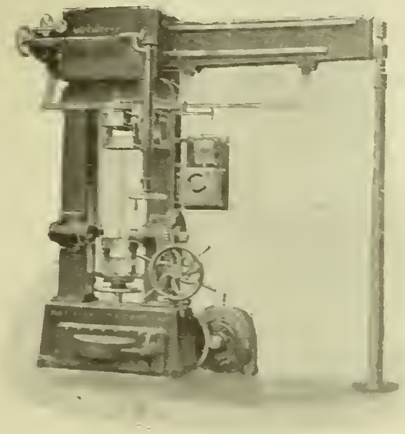

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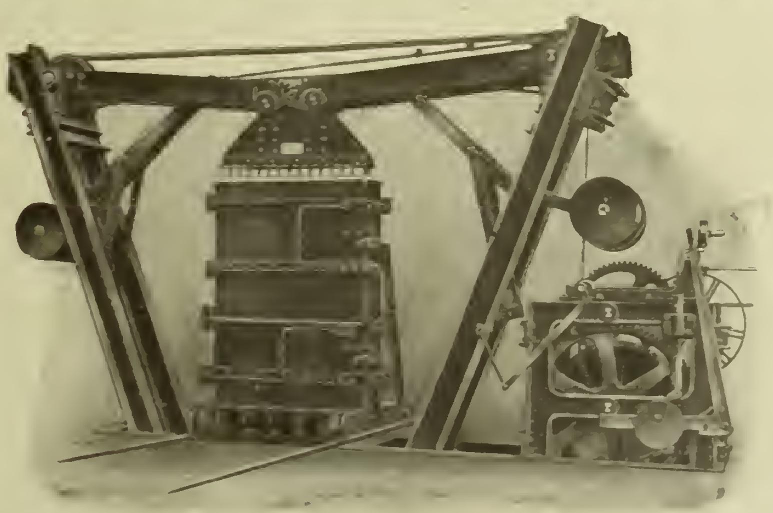

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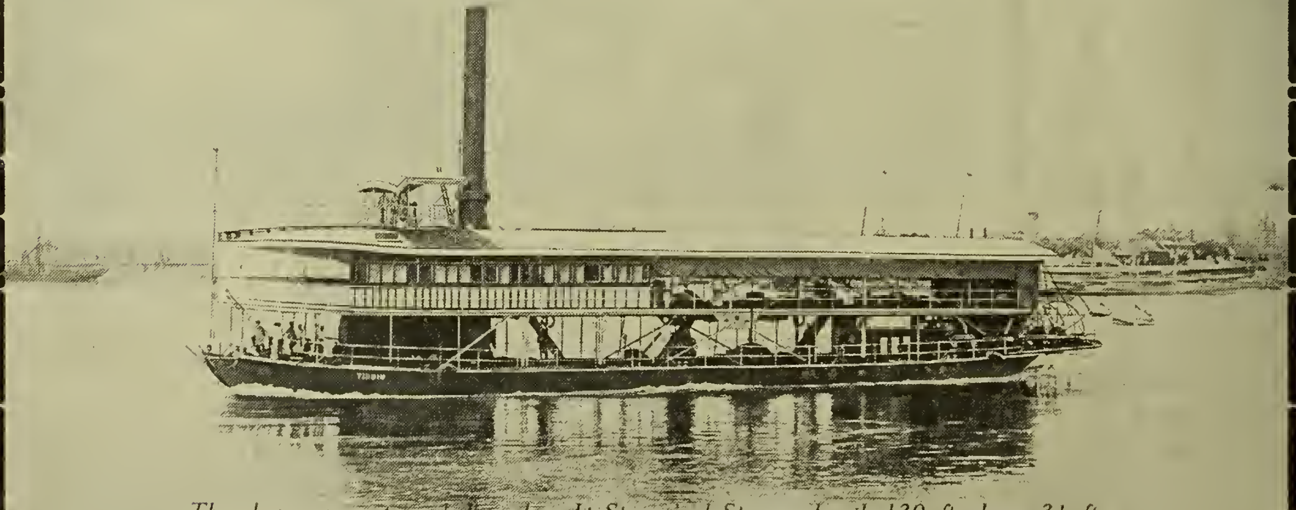

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EASTERN ENGINEERING

Vol. XI.—No. 6.] *JUNE 24, 1920.* [New Series.

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NOTES AND COMMENTS.

ENGINEERING AT THE CRYSTAL PALACE.

To a very great extent the exhibition now open in London at the Crystal Palace may be regarded as an Engineering Exhibition. It will remain open until the beginning of October. Ample time will thus be given for full examination and consideration of the many important exhibits and the beneficial effects the exhibitors should receive are likely to be very far reaching indeed. In subsequent issues of this journal illustrated articles will appear of machinery now being shown at Sydenham of direct interest to Far Eastern markets. Many well-known engineering concerns are represented. The Vickers Company and its associated enterprises have combined to make a very effective display. These include oil engines, motor launches, and agricultural machinery; also a new type of motor-driven breaking down mill suitable for coal, rolling iron, steel, and non-ferrous metals. Types of locomotive engines by Messrs. Armstrong, Whitworth are shown, together with marine engines and boilers, machine tools, and hand pneumatic tools. Messrs. Beardmore also show a model of their main line locomotives. An interesting feature of this exhibit is a semi-Diesel hot-bulb valveless crude oil engine designed for both land and marine use. The Oil Section of the exhibition is sufficiently representative of the great attention given of late to the use of oil fuel, and many types of oil-burners and liquid fuel installations are shown. An interesting exhibit shown by Messrs. Mirrlees, Bickerton & Day, of Stockport, is the first Diesel engine made in Great Britain twenty-three years ago of 20 h.p. Beside this there is a four-cylinder 200 b.h.p. engine of modern type. The exhibition offers excellent testimony of the readiness with which manufacturers have again diverted their activities to peace requirements. The testimony is the more striking as their commercial products are shown almost side by side with their contributions in recent years to war material. Very many features and important developments shown in the exhibits deserve very wide publicity, which should not be lessened because the exhibition is not a purely trade concern. So many exhibitions are being held at present in Great Britain, or are due to be held shortly, that complaints are not uncommon of the difficulty of being represented everywhere, either as exhibitor or visitor. This applies particularly to firms whose manufactures cover a wide range of industries. Personally we should like fewer exhibitions held at home and more organised abroad. The best alternative to this would seem to be that the fullest notice of current exhibitions space permits should be given in the pages of journals with foreign circulation.

SCIENTIFIC RESEARCH.

The progress made in Great Britain during and since the war in scientific research has often been commented upon in these pages, which have also given a record of the measures taken to promote such development. Practically similar activity and enterprise have been characteristic of Germany, America, Italy, and France, and in the aggregate the progress made may be immense, although so little is known as to what has been actually accomplished. In the circumstances, however, it is gratifying to learn that the British Department of Scientific and Industrial Research is quoted by the highest authorities in the United States as the farthest advanced in actual performance. The thoroughness with which preliminary as well as ultimate work is undertaken by the Department's research associations is taken as an example to be borne in mind in the United States This opinion was expressed some time back, and has since been supplemented and reaffirmed. As we have already mentioned, voluntary and national organisations for research are now in existence in most countries. Nor is the Far East lacking, as in Japan a national physico-chemical institute was founded some time since for the development of Japanese industries, and according to the method that the Japanese have used so successfully in other branches of work during the last half-century young men of promise are being appointed to research fellowships and being sent abroad. War, in short, has had its usual influence on research, but in the present instance this special influence has been more marked, and to-day every nation is mobilising its scientific and industrial resources consciously, and we believe with beneficial effect.

A MODERN GENERATING STATION.

Particulars of what is claimed to be probably the most efficient generating station in the world were recently furnished in a lecture delivered in the North of England before the North-East Coast Institution of Engineers and Shipbuilders. The plant in question forms the Carville "B" station of the Newcastle-upon-Tyne Electric Supply Company. Its capacity is 50,000 kw. There are two boiler houses, each containing two banks of three three-grate water-tube boilers. Each complete unit consists of boiler, superheater and economiser and is capable of evaporating at all times 45,000 lb. of water per hour when burning coal having a calorific value of 9,000 to 11.000 B.Th.U. at a pressure of 270 lb. above atmosphere and superheated to 675 deg. F. from water supplied at a temperature of 90 deg. F. The temperature of the outlet gases enables the economisers to raise the feed water required for the boiler to about 220 deg. F., the outlet gases leaving the economiser at about 350 deg. F. Mechanical draught, both forced and induced resulting in balanced draught in the furnace is provided to enable coal of a low grade to be burnt. The efficiency obtained on tests—based upon the higher calorific value of the coal which has been mentioned—amounts to 85.5 per cent. The engine-room contains five three-phase turbo-alternators having an economical output of 10,000 kw. each, at a pressure of 5 750 volts, and a periodicity of 40 complete cycles, running at 2,400 r.p.m. Each machine is complete with a direct-coupled exciter, condenser, turbine oil-cooler, oil filter and air filter. The turbines are of the horizontal reaction type, of Parsons make, and are provided with high and low-pressure cylinders, the latter being double-ended.

The surface condensing plant is placed immediately below the low-pressure cylinder, and consists of twin condensers connected in parallel bolted direct to the exhaust flanges of the turbine. The air-extracting plant consists of a steam jet and augmentor in series, with a totally-enclosed reciprocating pump. The condensate is discharged by the lift pump through a feed-water heater taking steam extracted from the L.P. end of the turbine, into the hot well. This method of heating the condensate results in an appreciable gain in economy. The plant as a whole is capable of maintaining a vacuum of about 96½ per cent. The circulating water for the condensers is provided by means of a pump house at the river, situated near the power station, at about 130 yards distant. The alternators are of the rotating-field type with direct-coupled exciters, and are totally enclosed and ventilated by means of fans. One of the special features of these machines is the water-cooling of the rotor, which is carried out by pumping through tubes placed at the bottom of the slots in the rotor, with a special cooler in circuit for cooling the water. The steam consumption is given as 10 lb. per kw. hour, the capacity per sq. ft. of area covered as 15 kw., and the capacity per man engaged in operation as 633 kw. Whilst the station has lacked many of the difficulties which have attended the Shanghai Electricity Department, both have many points in common. Both are the outcome of continued and great improvement and development under British management, and in both there has been a continuous and strenuous endeavour to meet growing requirements for current.

PRODUCTION IN THE UNITED STATES.

Few who have studied international trade will be ignorant of, or will question, the fact that the United States has become a foreign trading nation. A matter, however, which is by no means such common knowledge, but which it is essential we should realise, concerns the great expansion that has taken place in America during the last few years in the agencies and instruments of production. So great has been this expansion that America cannot again limit her trade outlook to domestic demands. Something very much like disaster will overtake American commerce and industry unless she can steer into American channels a very considerable share of foreign trade. Plant expansion in the States for greater production has by no means only been accomplished by concerns of great magnitude and large capital. Mr. James A. Farrell, chairman of the American Foreign Trade Council, has stated that the increase in productive capacity is common to all industrial sections of the country—along the Atlantic Coast, in the South, in the Middle-West especially, and on the Pacific Coast. Detail is not lacking in Mr. Farrell's statement, for he tells us that in one district of the State of Ohio alone, embracing but a comparatively small part of its area, several sheets of closely typewritten paper would be required to list, one name to a line, the plants which were expanded to meet the requirements caused by war-time conditions. Truly, an enormous machine for production has been created, and America is giving sustained and intelligent effort to its working. Wisely used, no doubt the world will be the better for its creation. Nevertheless, American foreign enterprise is a potent factor to be reckoned with, Such competition in catering for the needs of foreign markets can best be met by the ready adaptability of other nations to adjust themselves to changed conditions, and by a broader and freer conception of international co-operation. The causes which have brought greater productive facilities to America have achieved the same end in Great Britain in an even greater degree, and, granting that the ability for salesmanship and distribution have developed proportionately, then the future may be faced with confidence. It is essential, however, that we should realise what our competitors are doing.

MODERNISING GAS INDUSTRY LEGISLATION.

The measures so frequently taken in Great Britain to promote the welfare of particular industries might, and doubtless will, receive attention in other countries, where similar industries are conducted. Of such measures the new Gas Bill, recently submitted to Parliament, is one of the most important. Engineers of the industry in Great Britain have for long been handicapped in their endeavours to improve and reduce the cost of heat, motive power, and light, by legislative restrictions long out of date, and framed to secure a standard of gas defined by its lighting power in old-type standard burners. Many improvements in gas-burning appliances and in gas consumption have taken place since such restrictions were imposed. The internal combustion was introduced about 1860, the incandescent mantle in 1895, followed by the use of high-pressure incandescent gas, all such developments depending, not on the illuminating power, but on the total heat units given out by combustion. Moreover, the gas consumed to-day for heat and motive power is nearly double that used for illumination. The proposed Gas Regulation Bill of 1920 provides, therefore, that the consumer is to be charged for thermal units supplied in the form of gas, instead of selling by cubic foot measurement. A unit of 100,000 British thermal units, called a "therm," is set up as the standard. The meter measuring cubic feet will still be used, but its record is reduced to "therms," by the readings of recording calorimeters, which will show a continuous heat unit record. A wide range of heat values per cubic foot is allowed different companies and municipalities, and the Bill as a whole will enable gas engineers to obtain from coal and to distribute a much larger proportion of the total heat of the coal in the form of gas than has hitherto been possible. The future of the gas industry in Great Britain is regarded with increasing confidence, and the greatly increased use of gas, particularly for industrial purposes, is predicted. Better methods of gas production and improved treatment of by-products are also strengthening the position of the industry. Of these the Low Temperature Carbonisation system, recently dealt with in these pages, is an example, while another instance will probably be found in the use of oxygen in the carbonisation of coal. By this system the heat needed can be generated in the charge itself by the use of oxygen, and the complete gasification of coal obtained with the maximum thermal efficiency.

WIDE FIELD FOR ELECTRICAL ENGINEERING.

In most civilised countries to-day very great prospects are opening up for electrical engineering. This is clearly the case in the Far East, and perhaps the position is simplified if an endeavour be made to appreciate the numerous forms in which electricity is not only applicable but invaluable. With the transmission of light and power we are all familiar, although even here we may fail to do justice to the great scope that exists for this branch of the industry. The possibilities for electric traction on our railways and for road transport have yet to be grasped in their just proportions. Still less do we realise the important rôle electricity and electro-magnetism play in the transmission of spoken and written messages, and with all that electricity does, or can do, on board ship. The great part electricity takes in manufacturing processes, quite distinct from supplying the power, is but little credited, nor are its medical, agricultural, and chemical applications. Great as are its present uses, important developments may be anticipated. The substitution of mechanical with electrical apparatus is a case in point. The question of distant control by electrical current in another direction in which such developments may be discerned. The problems attending the distant control by electricity of aircraft have already been overcome, although the developments here are not yet on a commercial basis. The tenders recently called for by the Post Office in London for the electrical equipment of the London underground mails tunnel embodying some method of distant control brings this matter appreciably nearer realisation. Success in this instance may well lead by degrees to similar control on our railways with benefits proportionately greater in these circumstances. It is something of an anti-climax to learn that in Great Britain the Electrical Development Association is in active operation to familiarise the general public with the advantages of electricity and to encourage its use. It is believed that such an Association will never be required in the Far East where perhaps the benefits of electricity are more generally appreciated than anywhere in the world, and where the scope before the industry is greater. Familiar with the industrial outlook, and with all that electricity can do for industry, one cannot fail to realise the great potentialities for electrical engineering in this part of the world.

— —

DEVELOPMENTS IN THE RUBBER INDUSTRY.

To Mr. S. J. Peachey, M.Sc.Tech., F.I.C., lecturer in chemistry at the Manchester College of Technology, is credited further improvements in the process of the vulcanising of rubber. For eighteen months or more a good deal of publicity has been given such developments. By the new method organic filling agents may be employed, thus making it possible to use many substitutes that are relatively cheap compared with the materials at present in use. A much wider range of colours may be employed. By the improved process vulcanisation is effected without the application of heat, and it can be accomplished in about half an hour in comparison with from one to three hours by the present method. Sulphur is introduced into the rubber by means of sulphurous gases, and hydrogen sulphide and sulphur dioxide when applied alternately to the rubber mixture bring about complete vulcanisation. If when employed commercially the improvements carry with them all the advantages claimed in the laboratory, the net result should be a material cheapening of rubber goods and the employment of rubber in a much wider range of goods than hitherto. In any case the Manchester College of Technology deserves well of science and industry for what it has accomplished in the past. During the war, Mr. Peachey prepared and patented a new rubber product, "Duroplene," samples of which were supplied to the Air Board and the Trench Warfare Department for experimental purposes. He also discovered a new accelerator for the vulcanising of rubber. Other members of the staff perfected a method of analysis of nitro compounds, including high explosive, by means of titanous chloride, and a valuable series of experiments were conducted in the best methods of manufacturing tri-nitrotoluene and picric acid. The investigation was carried out of the manufacture of dopes for aeroplanes without the use of acetone, and a new method of producing dopes discovered. A special dope was also produced for rigid airships. Much other valuable work in the fields of metallurgy and dyestuffs research has also been accomplished.

MARCONI'S WIRELESS TELEGRAPH CO., LTD.

A highly satisfactory report has been issued by this company for the past year. Earnings have more than doubled, the gross profit amounting to £1,538,000, as against £766,300, and the net profit to £1,220,700, as compared with £597,900. There are evidences that revenue is shown after very liberal deductions. For instance, £56,000 has been written off investments and 58,000 has been debited to profit and loss as loss on exchange on income accruing abroad, though much of this money has not been actually brought home and, if not remitted till the exchange improves, will prove a source of extra profit in the future. The bulk of the increase is, of course, represented by the £590,000 received from the Government as damages for breach of contract in connection with the arrangement for a chain of wireless telegraphic installations throughout the Empire, but, apart from this, receipts on trading account register a gain of £181,300. The Preference and Ordinary dividends remain at 22 and 25 per cent. respectively, but both classes of shareholders get a bonus of 25 per cent. The bonus will absorb £368,400 out of the £590,000 received from the Government. The dividend is payable on the capital as it stood before the last issue of Ordinary shares, these latter not ranking for return till the current year.

CREDITS FOR EXPORTERS IN THE UNITED KINGDOM.

In April last the Export Credit Scheme was discussed in the House of Commons, and a synopsis of same was given in the issue of this journal of that month. The Board of Trade has now issued a memorandum (Cmd. 732) which revises and amends the original scheme. The scheme is not intended to encourage all kinds of exports; in fact, Clause 8 explains that:—

> Advances will not be made for the export of raw materials or of surplus Government stores, and preference will be given to the finance of goods where the larger part of the cost is due to manufacture in Great Britain. Goods are only eligible which are manufactured or produced either wholly or partly in Great Britain.

Moreover, the exporter's bank must recommend the application and must send it to the Export Credits Department of the Board of Trade.

Applicants must be firms or companies domiciled in the United Kingdom. Advances may be granted up to 80 per cent. of the cost (to the exporter) of the goods in respect of exports to various countries. The word cost includes the exporter's disbursements for freight, insurance, and commission paid to the Export Credits Department. There seems to be a welcome absence of red tape about this new office. For the convenience of exporters the Department is ready to receive applications before the contract is signed, and to give a decision upon them: a limit of time must be stated within which the shipping and other relevant documents will be produced and an advance taken.

The Department "will make the advance to the exporter upon the receipt of the bills of exchange, shipping documents, etc." It will not wait for the bills of exchange to be accepted, but it will require with them a guarantee from the importer's bank to the effect that they will be accepted and that the stipulated security will be deposited as soon as the documents are presented to the importer. Where the Department requires it the guarantee must undertake that the value of the securities will be maintained. Various other conditions are laid down for the protection of the Department. No fixed period is prescribed for the credits; the Department reserves the right to fix one in each case, but it must not exceed three years. The interest charged is very much like that charged by banks for overdrafts or advances, i.e., 1 per cent. above bank rate, with a minimum of 6 per cent. In addition the Department will charge commissions to defray its own expenses and to provide a fund against losses, the rate being not less than 3 per cent. for the first year, 4 per cent. for the second, and 5 per cent. for the third year. In case the bill of exchange is paid before maturity a rebate will be allowed; but a minimum of 2 per cent. will be maintained. This rule is not quite so rigid as it seems, for it is stated in a later paragraph that:—

> In approved cases, where the exporter is prepared to remain liable to repay the advance, the Department would be willing to modify the requirements as to security and to make a reduction in the commission to the extent of half the rates (mentioned in the earlier paragraph).

ECONOMY IN STEAM BOILER PLANTS.

The Vapour-Accumulator System, a recent Swedish invention patented by Mr. J. Ruths, is designed to regulate the load in steam boiler plants. It is described as being based upon the principle of stowing up steam in superheated water contained in a large receiver provided with automatic regulating devices. When arranged according to this system it is claimed the boiler plant does not require a heating-surface corresponding to the maximum quantity of steam required per hour, but may be designed for the iron and steel industry: the vapour-accumulator may be used for an efficient utilisation of the hot gases from blast furnaces and other furnaces, and also for holding steam in readiness for the generation of power. After installing a vapour-accumulator at the Sandviken Iron Works in Sweden, it is stated to have been found possible to close down two boiler houses and to dispense with the services of fourteen stokers.

ENGINEERING, MINING AND INDUSTRIAL PROJECTS IN THE FAR EAST.

COAL-MINING ENTERPRISE IN JAPAN.

There is considerable activity in coal-mining enterprises in Japan at the present time, and the organisation of several new companies is being contemplated. At the same time, it is considered doubtful whether such concerns will prove commercially successful should there be any considerable reduction in the price of coal. The promoters are counting rather unduly on a continued increase of Japan's industrial activity. As a great potential market, however, for colliery plant and equipment, the position in Japan is well worth judicious exploitation. Better mining methods are everywhere being aimed at in Japan, and coal resources hitherto neglected as non-payable propositions will be utilised. The larger concerns, such as the Mitsubishi Kogyo Kabushiki Kaisha, regard the future with confidence, the undertaking named materially increasing its capital, investment in the undertaking now being open to the general public. Statistics as to Japan's coal resources and production appear elsewhere in this issue.

MOJI HARBOUR IMPROVEMENTS.

The proposals for the improvement of Moji Harbour, on the North Kyushu coast of Japan, include:—

1. The acquisition by purchase of 240,000 sq. yards of water frontage and the reclamation from the sea of another 320,000 sq. yards at Tanoura, a fishing village situated about one mile from Moji, a bold headland, known as Moji Hill, intervening between Moji Harbour and Tanoura.
2. The construction of a deep-water anchorage, free from the tidal currents which form the chief defect of Moji Harbour, where vessels of any size could ride safely; of coaling wharves, jetties, etc., and of proper port equipment, and the provision of warehouses, coal storage yards, etc.
3. The construction of a railway of some 15 miles in length from Tanoura, connecting with the Government main line at Moji station, with the Kokura railway at Ishida station, and with the Hoshu railway at Soné station. All these are coal-carrying lines, and the rail facilities thus provided will enable coal to be conveyed by rail, as well as by water, direct from the collieries to the new harbour, and will also enable the transport by rail of cargo to and from the shipping using the harbour.
4. Of the land to be acquired by purchase and reclamation some 300,000 sq. yards will be offered for sale. On this land streets will be laid out, and it is anticipated that a profit, estimated at £1,500,000, will accrue from these sales.

The work is being carried out by the Moji Chikko Kabushiki Kaisha (Moji Harbour Construction Co., Ltd.).

MONO-RAIL ELECTRIC TRAMWAY FOR TOKYO.

To relieve the congestion of travelling in Tokyo, and as an auxiliary to the municipal electric car service, several business men of the capital, including Mr. Yoshio Naito, as announced some little time back, approached the Government for permission to build a mono-rail electric tramway over the rivers and canals in Tokyo. Details since to hand show that the scheme proposes to start the line near Shimbashi, over the canals, thence over the Sumida River as far as Yoroibashi, near the Stock Exchange. The terminus will be Tabata, on the Government railway. Each car will be capable of accommodating 50 persons, and will be run at an average speed of about 25 miles per hour. The proposed company is to be capitalised at 15,000,000 yen. The estimated cost of building the line is about 1,630,000 yen per mile.

DEVELOPMENTS AT YOKOHAMA.

Particulars were given in the March issue of this Journal of the plans under consideration for the development of Yokohama, particularly in relation to harbour improvements comprising extra docking space, deepening of slips and increased wharfage facilities. The proposed programme for city betterment is, we learn, likely to be hastened with a view to finding employment for labour rendered idle by recent commercial difficulties in Japan. As rather more than 35 per cent. of the foreign trade of Japan is credited to Yokohama the improvements already made, as well as those which are contemplated, represent a remunerative project. Increased facilities and extensions are necessary, and indeed are contemplated at most important ports in the Far East, and contracts forthcoming from this direction are amongst the most apparent openings for business in this part of the world. The present port at Yokohama includes the old Customs compound, covering an area of about 610,360 square feet and containing ten sheds and several storehouses, and the new Customs compound, which is much larger, its area being 4,250,000 square feet, including the new port and pier. There are eleven steel sheds, covering 358,308 square feet, and three wooden ones, occupying 104,256 ft. In addition there are two three-storey brick warehouses, occupying 69,394 square feet and containing steel galleries, elevators and other modern equipment. The main railway line is connected with the quays by two lines and with the old Customs compound by one. There is also a wide-gauge line for about a mile along the quays for the use of the electric travelling cranes. The water depth on both sides of the pier has been dredged to 35 ft. below the mean low-water spring tide.

JAPANESE ENTERPRISE IN SUGAR INDUSTRY.

It is reported that the Japanese combine which recently purchased the sugar factory at Krajan Rejo, Netherlands Indies, for 4½ million florins, has now completed negotiations for the purchase of the Wijnschenk factories in the Djokja district for the sum of 16½ million florins.

RAILWAY CONNECTION BETWEEN CHANGSHA AND CHANGTEH.

The construction is now being put in hand of a branch line of the Canton-Hankow Railway from Changsha to Changteh, a distance of over 100 miles. While the new branch is not of the same economic importance as if it were opening up inaccessible territory, since Changteh is connected with Hankow by water, it will make possible the movement of freight from Changteh *via* Changsha during the four or five months when the water of the Tungting Lake is too low to permit of river steamers reaching that city. This branch will ultimately involve the construction of a bridge over the Ssiang River near Changsha.

RAILWAY AND BANKING PROJECTS IN MUKDEN.

Increased attention is now being given in the Mukden district, comprising the greater part of South Manchuria, to the installation of better facilities for transport and for banking. In both respects services at present available are quite insufficient. A number of new railway connections are projected, the principal ones being Japanese, and including:—

	Miles.
Kirin-Hweining Line	160
Changchun-Taonanfu Line	150
Taonanfu-Jehol Line	370
From a point on the Taonanfu-Jehol Line to the sea	150
Kirin-Kaiyuan *via* Hailungcheng	170
Ssupingkai-Taonanfu Line	100

There is also the American project of linking up Chinchow to Aigun, a distance of 700 miles.

Whilst the manufactures of the Mukden district are unimportant, compared with the agricultural development, industrial possibilties are very great. The number of business houses has rapidly increased of late, building operations have become extensive, and the call for improved and increased railway facilities is pointed out. Practically the same remarks apply to banking, and certain interests are actively considering the formation of an American bank in Mukden, and a favourable opportunity certainly exists at the present time for carrying this project to fruition.

FRANCO-BRITISH RAILWAY PROJECTS.

Preparations are advanced for the construction of a railway to connect Upper Laos with the Annamese coast. In connection with this project, the French Colonial Union proposes that all new railway construction in Asia should be with the ultimate object of realising a Franco-British scheme for linking by rail all the colonial possessions and dependencies of the two Allies. Such a line would pass through Siam, Burmah, India, Persia, Mesopotamia, and Syria. The Union makes no suggestion regarding the route to be followed over spheres of complete British influence, but points out that Annam and Tonkin could be connected with Siam and Burmah by two routes, either by the creation of a new system across Northern Siam by way of Vinh or by the adaptation of existing railways through Moulmein, Raheng, and Khorat. In order that the railway at present under consideration for Upper Laos might be utilised, such a trans-Siamese line would have to be directed towards Guang Tri and Savannaket.

CULTIVATION OF AFRICAN OIL PALM IN MALAYA.

The Government of Perak is prepared to grant land upon favourable terms for the cultivation of African oil palms. At present the chief countries of origin of this oil are Southern Nigeria, the Gold Coast, Sierra Leone, the French Ivory Coast, and the Congo. It is thought that, as Malaya has the advantages of available labour and facilities for transhipment, this cultivation could be carried on most successfully. The Department of Agriculture and several managers of rubber estates have been conducting experiments and have found that the soil and climate of Malaya are well adapted to this plant, and that its oil content is equal to those grown in South Africa. The oil is mainly used in making butter substitutes and soap. The 50,000 acres of land set aside for oil-palm plantations are reported as being planted as rapidly as the jungle can be cleared away and the ground put into suitable condition. This means an increased market for tractors, stump-pullers, portable saw outfits, ploughs, vegetable-oil mill machinery, and kindred equipment.

DRAINAGE AND RAILWAY SCHEMES FOR THE F.M.S.

At a recent meeting of the Federal Council of the Federated Malay States the Governor foreshadowed a scheme for the uniform supply of electric power to the Straits Settlements and Federated Malay States. An expert has been engaged to go into the matter.

Among other subjects raised were the draining of a large area of land for the growth of foodstuffs and the acquisition of land for a large goods station at Tanjong Pagar, in Singapore. The last item is of interest, as on the completion of the Jahore causeway there will be through communication for goods traffic from Singapore to all the important centres of the Federated Malay States.

EAST INDIAN DEVELOPMENTS.

Mr. G. O. Blacker, Commissioner in the East Indies for the Federation of British Industries, reports that the Federated Malay States Railways intend to construct a large railway goods station at Tanjong Pagar, Singapore. This station will be alongside the Tangjong Pagar wharves.

Information has also been received that the projected State Railway in the Residency of Tapanoeli, Sumatra, will consist of a line running from the capital, Sibolga, to Padang Sidempoean, along the route at present followed by the Government motor service. Including the harbour line at Sibolga, the length will be about 100 kilometres. It is proposed eventually to extend this railway southwards to Penjaboengan—a distance of 70 kilometres—and in a north-easterly direction to Koto Pinang, with a view to connecting up with the Deli Railway. The construction of this railway will necessitate the erection of bridges over two of the rivers in Tapanoeli. Railway wagons and goods trucks in the Dutch East Indies are believed to be very scarce. It is stated that the Netherlands Government are taking steps for the development and improvement of communications in North-West Borneo. Initial operations include the laying of a steam tramway from Pontianak to Sambas. Mr. Blacker also mentions that the American "Firestone" Rubber Co. intend to erect a factory in Singapore, as being in the immediate vicinity of sources of supply of the raw material.

INTERNATIONAL MOTOR SHOW AT BANDOENG.

The Bandoeng Fair Association has arranged for an International Motor Show in 1921, at Bandoeng. This will meet the wishes of motor car importers in Holland East India, who were not allowed to exhibit at the First N.I. Industrial Fair of this year. Bandoeng is situated at an altitude of 2,400 ft., is a very modern city, with a cool climate, and provided with all modern comforts. It is certainly well placed for shows of this kind, which should be an attraction for home and foreign visitors.

BRITISH CHAMBER OF COMMERCE FOR N.E. INDIES.

The British Chamber of Commerce for the Netherlands East Indies has been founded in London with temporary offices at 38, Dover Street, Piccadilly, W. The first President is the Right. Hon. Lord Emmott, G.C.M.G., G.B.E., and the Council has been fortunate in securing as its Governor, Sir Walter Townley, K.C.M.G., who during the latter part of the war occupied the post of British Minister in Holland. Sir Walter Townley intends to devote the greater part of his energies to the welfare of the Chamber. Mr. C. M. Morrell is Secretary of the Chamber. Until recently Mr. Morrell was assistant to H.M. Commercial Secretary at the British Embassy, Brussels. Committees will be elected from each group of industries, and special committees will be appointed to study and report upon particular subjects. It is also intended to instal small but thoroughly representative committees in Java, Sumatra, and other countries, and capable commercial men having a sound knowledge of the Dutch East Indian Colonies will be appointed as Intelligence Officers. The Chamber is non-political, and has for its broad function the furtherance of British Commerce in the Netherlands East Indies and the encouragement of trade and enterprise on sound businesslike lines. A monthly digest will be published dealing with questions and occurrences affecting British interests in the Indies. The Chamber has received a cordial welcome from both British and Dutch officials and commercial circles. Various Government Departments are amongst its strong supporters, and every endeavour will be made to maintain and extend close co-operation with them. The Chamber has every prospect of becoming a strong, virile body, embracing banks, shipping lines, rubber, tea, coffee, tobacco and tin companies, manufacturers, export firms and, in fact, all forms of British commercial and industrial enterprise connected with the Indies. The Council cordially invites co-operation and support. This invitation will be endorsed by all having at heart British interests in the Indies and the consolidation of the excellent international commercial relations existing between England and Holland. Dutch firms may associate themselves with the Chamber as affiliated members.

NEW TUBE AND IRON DRUM FACTORY AT BANDOENG.

The first Netherlands-Indies tube and iron drums factory has been established at Bandoeng. The factory is being built in the west part of the kotta near the Bandoeng gas works, where a site of 4,000 square metres has been acquired. The chairman will be Mr. W. Don, and the directors Messrs. Pleyte, Ament, Ormes and Schmitz. The capital is fl.1,000,000, of which fl.400,000 is paid up.

MACHINERY REQUIREMENTS OF THE DUTCH EAST INDIES.

Industrial machinery, particularly in connection with the sugar and coconut oil industries in the Philippines and Dutch East Indies is in increasing demand. A market for commercial motor vehicles is being developed on the Sumatra east coast. As the roads of the estates are being put in better condition, vehicles can readily be used to transport the crops to the railways. For general transportation between the port of Belawan and Medan and between Brastagi and Medan vehicles of $1\frac{1}{2}$ to 2 tons are being adopted.

CONSTRUCTIONAL WORK IN THE NETHERLANDS.

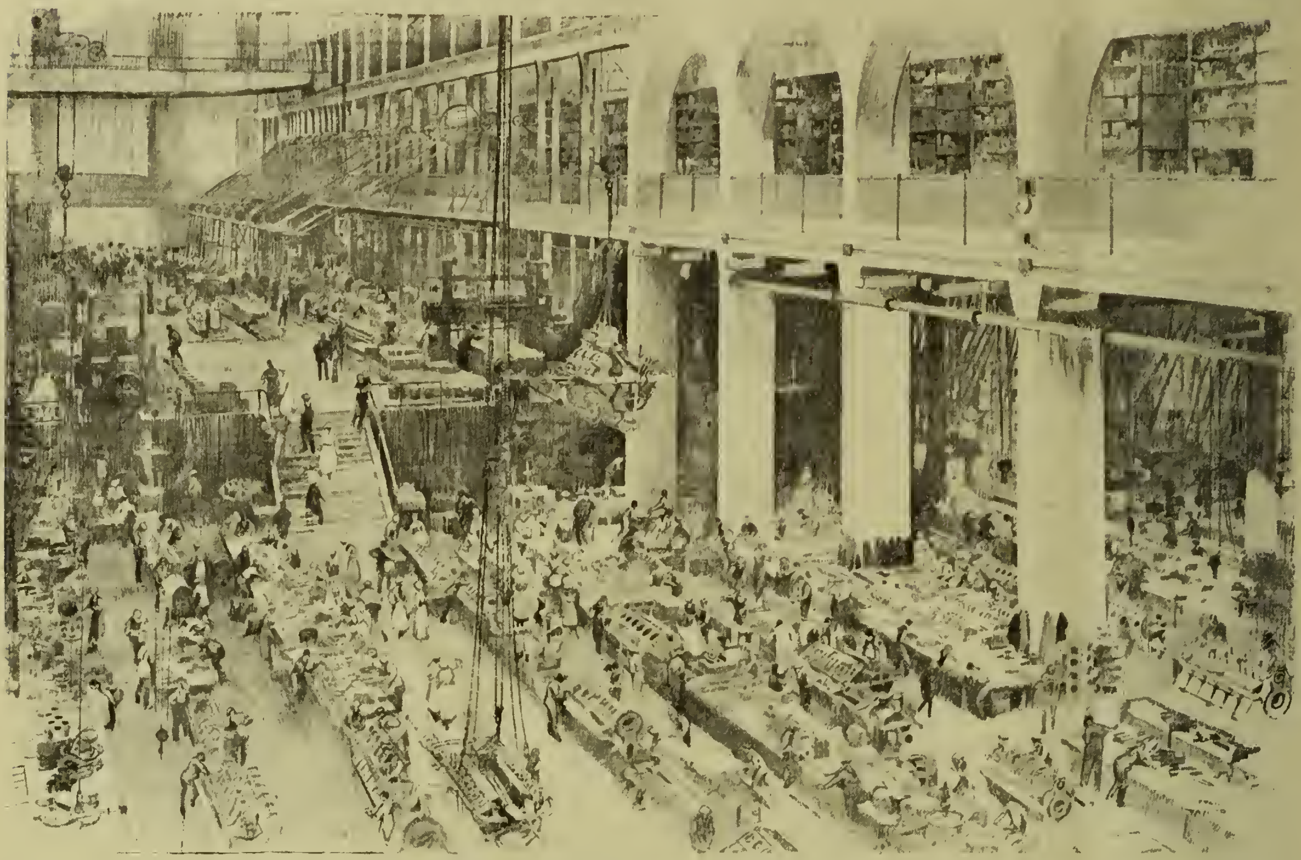
The Nederlandsche Maatschappji voor Havenwerken, which recently opened a branch at Bandoeng, has started work upon two important undertakings which run into million of florins. The first is the construction of warehouses, offices and sheds for the Java-China-Japan Line. The company has also undertaken the construction of the Moera Enim-Lahat railway in connection with which five locomotives and two steamboats have been ordered in America.

AMERICAN ENTERPRISE IN JAVA.

Messrs. Rogers, Brown and Co., the well-known American firm of importers and exporters, are establishing a branch at Sourabaya. This is indicative of the very greatly increased attention America contemplates giving to trade prospects in the Dutch Indies, and the announcement of similar projects by other large business concerns is anticipated. The development of the steamship communication between America and the East Indies strongly favours these plans. Native projects, such as sugar, tobacco, oil, oil seeds, and rubber, are now being despatched to the States, and American manufacturers are counting upon a large return demand for machinery and canned goods. Mr. J. W. Prins will be in charge of Messrs. Rogers, Brown and Co.'s new branch.

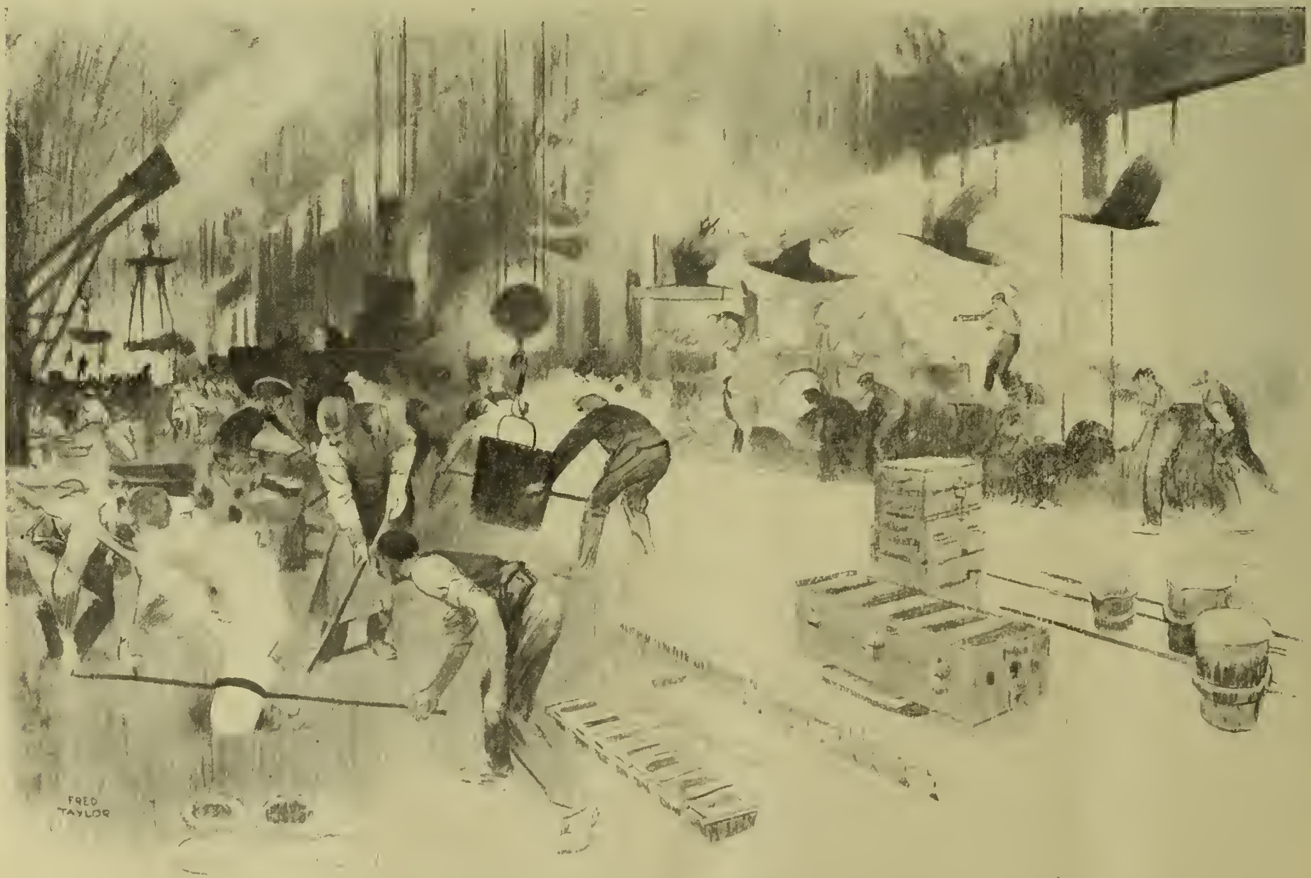
MESSRS. THORNYCROFT'S ACTIVITIES.

The illustrations on this page are reproduced from pencil drawings by Mr. Fred Taylor, R.I., supplied for Messrs. Thornycroft's book "A Retrospect and a Prospect," a notice of which appeared in the May issue of this Journal.



The Engine Erecting Shop, Basingstoke.

Besides Motor Vehicle work, Messrs. Thornycroft's Basingstoke Branch also has a large output of motors for boats, for driving dynamos, and for other purposes. During the war large extensions were made to the Basingstoke plant, and the output greatly increased.



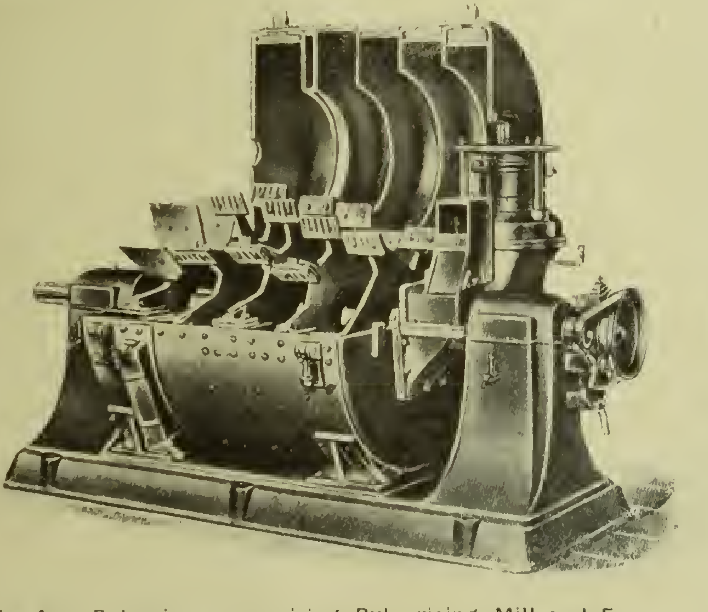
The Brass Foundry, Woolston.

At Woolston, Southampton, in addition to Torpedo Boat Destroyers and Shallow-draft River Steamers, Messrs. Thornycroft have ample facilities for undertaking the construction of a great variety of vessels for sea and river service.

PULVERISED COAL FUEL.

ITS ADVANTAGES, PREPARATION AND APPLICATION.

For industrial and manufacturing purposes, as well as for steam raising, the proper method of burning coal is in the powdered or pulverised form. This has been known for many years past, but only since a comparatively recent date have questions inseparable from the successful burning of coal in the pulverised state received attention and problems solved in connection with correct combustion area, velocity of gases at high temperatures, and the correct mixture of coal and air. As a result of a better understanding steady progress in the use of powdered fuel plants is recorded, both in Great Britain and America. A potent impetus has, of course, been given to this development by the great increase in the cost of fuel. Very great advantages attach to the use of pulverised coal, and there is little doubt that it will be widely taken up wherever industry is conducted on modern lines. In a paper recently read in London by Mr. McBryde before the Junior Institution of Engineers it was stated that by the use of pulverised coal, coal consumptions had been reduced from 20 to 50 per cent. Taking this as an outside estimate, the economy obtainable is very great, and very inferior fuels can be used with the same result as fuels high in calorific value. The smoke nuisance is eliminated and labour costs reduced. The fuel allows of practically the same flexibility and control as oil fuel, and in the case of boilers the steaming rate may be increased for long periods without damage to the boilers. By its use indeed the life of the boiler is prolonged, as the severe strain set up through large volumes of cold air rushing through the furnace when opening the furnace door for firing purposes, as in hand firing, is eliminated. When used in manufacturing processes, there is an increased output. Oxidation during heating of the metal handled is negligible, and the preservation and even the improvement of the quality of the finished product is assured. The system allows of great rapidity in heating, and gives equality of temperature. In modern plants no combustible matter is found in the ash, which is readily removable, and there is an elimination of stand-by losses.



The Aero-Pulveriser, comprising Pulverising Mill and Fan combined, and providing for small users all the advantages of powdered coal firing at a minimum cost for outlay and upkeep.

In the preparation of the fuel the present practice is generally to pass it through a crusher to facilitate drying and to prepare it for the pulveriser. The coal is then discharged on to a magnetic separator, where any stray pieces of metal are extracted. The dryers, into which the coal is then delivered, are generally of the rotary tubular type, the coal coming directly or indirectly into contact with the hot gases from a coal-fired furnace. A temperature of 250 deg. Fahr. is the maximum to which the coal should be submitted in drying. The coal is then fed to pulverisers and crushed to the requisite degree of fineness, the standard adopted being 85 per cent. of the coal to be capable of passing through a 200 mesh (40,000 holes to the sq. inch) and 95 per cent. through a 100 mesh. At this degree of fineness the coal burns practically like a gas or oil fuel, combustion being instantaneous and complete to within ½ to 1 per cent. From the pulverisers the powdered coal is conveyed either by compressed air or screw conveyor or by a combination of both to a storage bin convenient to the boiler or furnace. From this storage bin the coal is fed by a small side conveyor to the burner and blown into the combustion chamber by air pressure of from 2 to 3 ozs. to the sq. inch. The burners generally in use have extra air ports to allow for adjustment of the air supply to suit the coal used.

In water tube boilers the furnace is generally extended in front and converted into the combustion chamber. A ratio of 40 cubic ft. per lb. of coal burnt per minute is held as a good proportion to adopt for combustion space, but this may be considerably reduced and very good efficiency still maintained. In the Lancashire type of boiler a separate combustion chamber is as a rule built in front and connected to the boiler furnace by tubes, combustion taking place in this separate chamber, and the hot gases escaping to the boiler through the tubes. About 200 cubic ft. of air per lb. of coal is reckoned good practice. The temperature of the hot gases leaving the combustion chamber is in boiler practice about 2,700 deg. Fahr. The quantity of ash in the coal has only a slight effect towards reducing efficiency. Coal with an ash content as high as 50 per cent. has been successfully burned.

Serious apprehension is not entertained regarding spontaneous combustion of the fuel. Conveyors and storage bins should be dust proof to prevent coal escaping to the surrounding atmosphere, and it is not advisable to store coal for too long a period.

The following extract quoted in Mr. McBryde's paper, previously referred to, from a comparison recently made out will give an idea as to the economy effected by this method of firing.

Four Lancashire boilers, fitted with steam jets for forced draught using 100 tons of coal per week. Maker's rating 5,000 lbs. of water evaporated per hour. Under test showed 61 per cent. efficiency, the evaporation being 1,668,800 lbs. of water per week. 10 per cent. of the steam consumed by jets. Net evaporation 1,501,920 lbs. of water. The total coal bill, including labour for coal handling, stoking and ash removal, amounted to £200 per week.

With pulverised coal firing the efficiency was estimated at 78 per cent., and to obtain an equivalent net evaporation, as at present, only 73 tons of coal need be used. The coal bill, to include power and labour, amounted to £150 per week, equivalent to a saving of £2,600 per annum. Also, instead of using four boilers, it was proposed to equip two to work at full maker's rating, as the present boilers only worked at half-maker's rating, thus leaving two spare boilers to be used for other purposes.

This comparison from which the foregoing extract is made is similar to many others covering boiler plants in several of the large industrial cities of Great Britain.

The advantages of the system as applied to manufacturing and industrial purposes are well indicated in its recent application in welding tubes for water tube boilers in the French works of Messrs. Babcock & Wilcox, Ltd., particulars of which have been forwarded us. The trials in this case were carried out on an old grate-fired welding furnace fitted with a waste heat boiler, the space previously occupied by the grate being used as a combustion chamber. The welding furnace was divided into two compartments, one compartment for heating the tubes to be welded, the other being the hotter final welding-compartment. The pieces to be welded remain for some time in the first compartment, and are afterwards removed into the hotter compartment, where they remain about four minutes. With hand firing it was necessary to use a good long flame coal, and the consumption was 8,000 lbs. a day. After five months' continuous running the results obtained with the Aero Pulverizer were as follows:—The Aero Pulverizer is fed with a small, fine coal, of which the quality is very variable. Coals containing 10 per cent. of volatile matter and 25 per cent. of ash have been satisfactorily used, and an economy of 35 per cent. was realised, which means that the actual consumption of the furnace after powder fuel had been applied was a little over 5,000 lbs. a day. With hand firing a normal output was 55 welds per 10-hour day. At present they are obtaining 72 welds in a 9-hour day. One of the explanations of this increase in output is the uniform temperature obtained in the welding compartment. Cooling by the opening of doors of the firebox either for charging with coal or for cleaning grates is done away with.

In work of this character it is important to consider the effect of the furnace upon the metals being welded, and this detail was carefully watched. No oxidation that could be traced took place during heating, and it was possible to regulate the admission of air for combustion in such manner as to obtain an oxidising, neutral or reducing atmosphere.

Poor coal gave good results, and anthracite was satisfactorily used, provided the furnace was first heated.

This Aero Pulverizer, the type of machine used in this instance in conjunction with the furnaces for heating headers for welding, and illustrated in this article, was installed in May of last year, and has been running continuously with a normal output of 500 lbs. of coal per hour. On being thoroughly overhauled after four to five months' continuous running, the apparatus showed no appreciable signs of wear, and no spare parts have been used. The normal power absorbed was 11 h.p., and the one motor driving the machine ground the coal and delivered it to the furnace, no extra power being required either for a secondary air fan or any other purpose.

A brief description of the Aero-Pulveriser will be of value here, as it provides, for small users and in many other instances where the cost of a large central station would not be warranted, all the advantages of powdered coal firing, at a minimum cost for initial outlay and upkeep. The machine is a pulversing mill and fan combined. It consists of a rotor on a horizontal axis revolving in a steel casing, the whole machine being mounted on a cast-iron base plate. This base plate may be extended if desired so as to carry the electric motor driving the plant, the machine being either direct- or belt-driven.

The steel casing is divided into compartments, the compartment nearest to the delivery contains a blowing and exhausting fan; others contain paddles fitted with loaded blades, which crush and pulverise the coal in stages, the method of powdering being by impact. The coal is fed into the end of the machine farthest from the motor by an adjusting revolving table. This feed regulates the amount of coal burnt in the unit being fired. A hopper of suitable dimensions can be installed at this point holding sufficient fuel for an hour, a shift, or a day's run, according to the conditions of working the plant.

The air supply to the mill is admitted at two points. A proportion is allowed to enter at the same end as the coal by an adjustable shutter inlet, and this amount of air controls the velocity of the drift through the mill, thus regulating the fineness of the powder as required. Additional air is allowed to enter between the pulveriser and the fan, and can be considered as carrying-air for the distributing system. The air supply from these two sources may be kept below the amount required theoretically to support combustion in relation to the amount of coal used and the additional amount of air required for combustion can be induced at the burner. But even if the mixture in the distributing pipe is allowed to become inflammable, the speed of the mixture in the pipe is such that all chances of back-firing are non-existent.

There is no trouble in dealing with coals of an average moisture content owing to the facts that no powdered coal is stored, and the coal does not pass through fine screens. The Aero-Pulveriser is designed for installation on the unit system, one mill to each furnace or boiler fired.

Another fuel that is attracting great attention just now is colloidal oil, which is a mixture of pulverised coal and fuel oil. The coal is thoroughly mixed with the oil by both mechanical and chemical means. The mechanical part of the business is to thoroughly mix the two together, and the chemical added should have the property of causing the particles of coal to remain in suspension in the oil. The great difficulty has been to get an efficient fixative. This difficulty has now been overcome, and from experiments recently carried out excellent results were obtained. This mixture, should it be used commercially, will go far towards economy in the consumption of straight oil fuel.

WORLD'S OIL OUTPUT.

Latest statistics show that the cude oil output of the world in 1919 constitutes a record, amounting to 557,491,239 barrels. The following are the figures for the different countries in 1919 with those for 1918 (added in brackets) for comparison: United States, 377,719,000 (355,297,716); Mexico, 877,359,436 (63,828,327); Russia, 34,284,000 (40,456,182), Dutch East Indies, 15,780,000 (13,284,936); Rumania, 6,352,929 (8,730,235); India, 8,453,800 (8,000,000); Persia, 8,320,000 (7,200,000); Galicia (Poland), 6,255,300 (5,591,620); Peru, 2,560,000 (2,536,102); Japan and Formosa, 2,120,500 (2,449,069); Trinidad, 2,780,000 (2,082,068); Egypt, 2,548,000 (2,079,750); Scotland, 2,048,000 (2,032,000); Argentina, 1,504,300 (1,321,315); Germany, 925,420 (711,260); Canada, 220,000 (304,741); Venezuela, 245,300 (190,080); Italy, 38,254 (35,953); other countries (about) 25,000 (20,000). The total output in 1918 was 516,801,354 barrels.

HIGH CLASS CEMENTS FROM SLAG.

Prejudice has generally existed against every kind of cement made from slag, and engineers and architects have been apt to condemn all varieties without troubling to inquire into method of manufacture. Cements, however, can be made from blast-furnace slag equal or superior to London Portland cement, and thus importance will attach to the evidence in this connection brought forward by Mr. Edwin H. Lewis in a paper submitted by him to the Iron and Steel Institute.

Five classes of cements may be made from blast-furnace slag:—

(1) Blast-furnace slag consists mainly of the same constituents as Portland cement—lime, silica, and alumina—but in different proportions, and, instead of the raw materials being heated only to the point where the eutectic melts, they are completely fused. If a slag be reasonably high in lime, properly granulated, and afterwards finely ground, it has the properties of cement, though its settling time is slow.

(2) Under the head of slag cements may be included cements made from raw granulated slag and lime, finely ground together, with or without the addition of small quantities of other salts. Generally speaking, they are quite useful, and the cost of manufacture is relatively low; but they cannot and should not be compared with Portland cement. As the slag is not reburned, the sulphur contents are usually high, and the high-limed slags, which have the most cement-like properties, generally contain most sulphur. It is such cements that have created among engineers the great prejudice against any cement in which slag has been used as a raw material.

(3) The definition of Portland cement in the British Standard Specification can be satisfied by using slag and limestone in exactly the same way as the chalk and mud of the Thames and Medway are used, or any materials whatever which give the same proportions of lime, silica, and alumina. The manufacture of such cement from blast-furnace slag is carried on by the Universal Portland Cement Company in America.

(4) Some makers, finding the slow setting of the cement made from ground slag and lime to be a serious disadvantage, have made a rather better article by adding to granulated slag a proportion of Portland clinker burnt from a mixture of slag and limestone. Such an addition improves the setting time and strength of the cement, and reduces the quantity of sulphur, without adding very seriously to the cost.

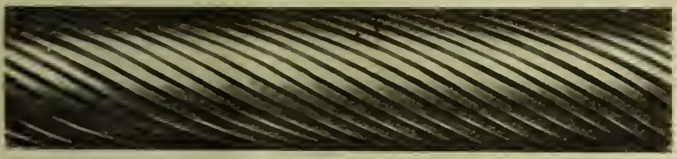
(5) If a certain quantity of properly granulated slag of the right chemical composition be added to Portland clinker during grinding the strength of tho cement can be increased. The quantity of slag which gives the greatest increase of strength wil naturally vary with the composition of the slag and clinker. In Germany it has been agreed that such cements shall be sold under the name of iron Portland cement, provided the quantity of slag added to the clinker does not exceed 30 per cent. of the whole. It is by making iron Portland cement instead of the inferior slag cements that ironmasters can break down the prejudice against all cements made from slags, for they will then be making an article that may excel in quality the best Portland cement. Except for the addition of granulated slag to the clinker as it goes to the finishing mills, the method of manufacture follows the dry process of making Portland cement. Nearly all blast-furnace slags can be used as raw material for making Portland cement, though in some cases a large addition of limestone would be required to increase the percentage of lime and reduce that of magnesia, etc.; but only some of them can be used for the subsequent addition to the clinker necessary for iron Portland cement. The latter can easily comply with all the British Standard Specification tests except that of specific gravity, and there is apparently therefore no reason why it should not be used for any purpose for which Portland cement is used. For sea water it should be especially suitable, since the added slag provides a means of protecting very efficiently lime from the magnesia salts which are apt to attack concrete made with Portland cement.

THE balance-sheet and report of the Austin Motor Co., Ltd., of Birmingham, show profit, £237,865; brought forward, £591,080; available, £828,946; dividend on preference shares, 7 per cent. per annum for the year, £17,500; dividend on "B" preference, 6 per cent. per annum, £49,148; bonus of one ordinary share for every two ordinary shares held, £200,000; write off expenses of issue of "B" preference capital, £88,303; cost of flying ground, £35,000; reserve, £425,000; carry forward, £13,995.

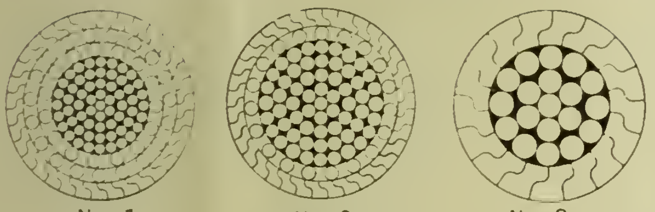
PREVENTION OF CORROSION IN LOCKED COIL ROPES.

Engineers and all users of wire ropes have in the past, indeed ever since the advent of the wire rope, been faced with the serious and difficult problem of the prevention of rust set up through contact with moisture, saline or corrosive water, hot fumes and by other means.

This danger, and often, unfortunately, consequent breakdown, is present in a greater or lesser degree not only in winding ropes, but in all classes and formations of ropes, as for instance in the case of those in use on aerial ropeways where the inaccesibility of the standing ropes on long spans renders any operation of dressing almost impracticable. It is apparent, therefore, that there must be a great risk of deterioration. This danger of corrosion is not altogether avoidable even with the best of dressings, and the risk is accentuated obviously according to the use to which the rope is put.



"Silverlock Locked Coil Rope.



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Sectional Views.

It is true that the high standard of quality and construction of the British manufacturer of wire ropes has been a guarantee of excellence and workmanship, and with the stranded rope which is composed wholly of round wires it has been found fairly possible to deal with the question of corrosion by the application of a suitable composition dressing which should be of the best. In the case of the locked coil rope, however, where extreme accuracy in the formation of the shaped wires is necessary in order to ensure efficient locking, the same remedy has been impracticable hitherto.

In these circumstances special interest will attach to the information which reaches us from George Cradock & Co., Ltd., of Wakefield, Yorkshire, that they have after much research and experimental work recently perfected and introduced a new method in the construction of their locked coil wire ropes, which effectively protects the rope against deterioration by corrosive action. This new process enables the firm to produce a locked coiled rope, in which *each separate wire* comprising the construction is coated during manufacture with a heavy layer of metallic covering, thus providing the rope as a whole, after the rope itself is spun, with the much needed and valuable protection required, and at the same time without interfering with the accuracy of section and perfect locking.

This development is being introduced under the name of Cradock's "Silverlock" locked coil rope. A sample exhibited at the recent Royal Agricultural Society's Show at Cardiff was received with much interest, and we understand a further exhibit of the rope is being made at the Royal Agricultural Show at Darlington (June 29 July 3). The rope is extremely flexible, and can be varied in construction to suit the many different working conditions. The development is one of great importance to all users of this type of rope, and gains enhanced prestige as coming from a firm which enjoys world-wide reputation for the excellence of its products.

The illustrations accompanying this article show the "Silverlock" locked coil rope in question; also sectional views.

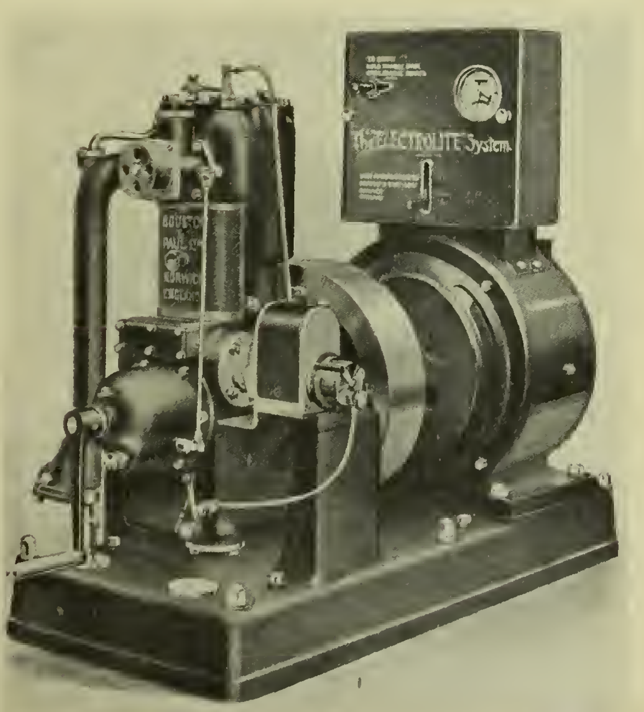
An official statement issued at Kuala Lumpur shows that during the past year the total production of tungsten ores in the Federated Malay States amounted to 436 tons, against 355½ tons in 1918. This came chiefly from the State of Selangor, and was made up of almost equal quantities of wolfram and scheelite. To encourage the winning of tungsten ores, the export duty is remitted at present.

IMPROVED TYPE SELF-CONTAINED GENERATING SET.

The present demand in the Far East for small self-contained generating sets for lighting and power engenders the desire that as much prominence as possible may be given to British plants of this description. Many large engineering concerns in Great Britain are turning out these sets in considerable quantities, and arrangements are practically complete for materially augmenting the supply. Those who contemplate installing such plant will therefore be well advised to consider in the first instance what British makers have to offer them. The potential demand in the Far East for this class of equipment must be very great indeed, as not only is the use of electricity in very great favour out here, particularly amongst the Chinese, but there are comparatively few large generating stations conducted on modern and efficient lines.

From time to time various types of generating sets have been described in these pages, and one of the latest types is now dealt with. It is manufactured under the title of the "Electro-lite" system by Messrs. Boulton and Paul, Limited, of Norwich, a fact which in itself conveys a guarantee of good design, workmanship and material. The accompanying illustration gives a general view of the installation, which embodies sound British engineering and electrical practices, and is designed with a view to giving satisfactory and lasting service. The output of the plant is 1,500 watts, and this is larger than a number of American plants now offered. This provides a margin of power for use in addition to lighting. The fuel used is paraffin, starting on petrol. The plant is semi-automatic, inasmuch as it automatically stops when the battery is charged. Starting is by hand, but without cranking, and is accomplished by merely depressing the starting switch, requiring no skill or physical exertion. The voltage employed as standard is 50 volts, which obviates the difficulty in obtaining lamps and fittings so often experienced with plants giving a lower voltage. Three different sizes of batteries are offered as standard, or the plant can be supplied complete with battery.

The generating plant comprises engine of four-stroke cycle type, developing 3 b.h.p. at 1,000 r.p.m.; shunt reverse compound type generator, 50-70 volt at 1,000 r.p.m. The reverse compounding is provided for motoring the engine for starting, and is cut out by the controlling switch; switch box, amp-hour meter, exhaust silencer, cooling and fuel tanks, etc. The switch panel is enclosed in a metal casing, and consists of panel, having mounted thereon a starting switch with automatic cut-out for battery circuit. The functions of this switch are, when the engine starts under its own power, it automatically cuts out the reverse compound. Should the main fuse blow, the engine will automatically stop. A D.P. house switch and fuse are provided, and D.P. fuse for charge circuit. Batteries of 26 cells, with acid hydrometer, etc., are provided ready for erection with wooden stands.



The "Electro-lite" Generating Set.

OIL FIRING FOR BOILERS AND FURNACES.

The increased cost of coal and labour are mainly responsible for the greater use of oil firing for boilers noticeable during recent years. Material economies are generally obtainable by the use of oil firing. Roughly the heating value of oil compared with coal varies between the following ratios:—

3 : 2 compared with coal containing 14,500 B.T.U. per lb.
2 : 1 ,, ,, ,, ,, 11,500 ,, ,,

An average evaporation from and at 212 deg. Fahr. of 15 lb. of water per lb. of oil burned can be estimated for an efficient boiler. The reduced cost of labour and cartage should also be considered when comparing costs. The more general employment of oil burners has also been aided by the convenience of this system of firing and by the advantages obtained by mixed firing (a combination of coal and oil-firing) for the purpose of meeting occasional peak loads instead of installing stand-by boilers. Several forms of efficient oil-burners and oil-burning installations are now at the disposal of the steam user applicable to stationary, locomotive and marine boilers and many types of furnaces, one or two types of which have already been dealt with in this Journal. The particulars now given describe the oil burners and appliances for oil firing manufactured by Messrs. Alldays & Onions, Ltd., of Birmingham.

This firm divides oil-burning systems into three main classes:—

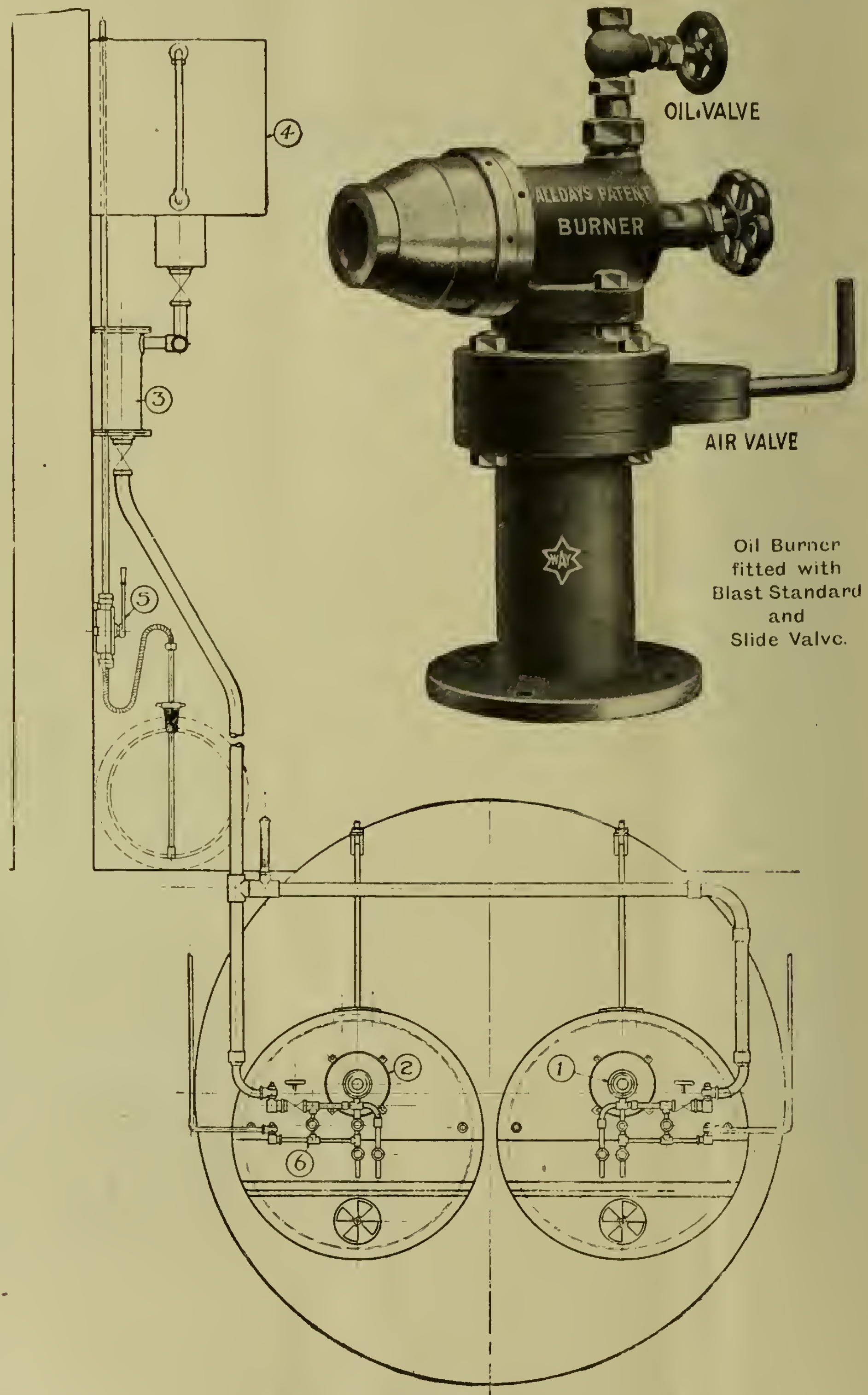
(1) Systems in which the oil flows by gravity, and is atomised at the burner by air under pressure.

(2) Systems in which the oil flows by gravity, and is atomised at the burner by dry steam at varying pressures.

(3) Systems in which the oil is put under pressure and sprayed through a special orifice

Messrs. Alldays & Onions' oil burners belong to classes 1 and 2, whichever means may be found most convenient for a given installation. They are suitable for burning creosote, crude and residual oils, as well as petroleum. In the case of very heavy viscous oils it is advisable to have this heated in a tank so as to allow it to flow freely.

Generally speaking, it is advisable for the firebars to be covered with a layer of firebricks 3 in. thick, and for the furnace doors to be replaced by special fittings, which are so constructed that the air supply to the combustion chamber can be closely regulated, as it is essential for efficient combustion that the proportions of oil and air should be correct. The firm's high pressure burners require an air supply of about 2 or 3 lb. per square inch, usually furnished by a positive pressure blower. Or they can be worked with dry steam at a pressure of not less than 30 lb. per sq. in. The low pressure burners require a comparatively low air pressure from 10 in. to 20 in. water gauge. A special size has been designed for boiler installations and for working with steam or with an air pressure of about 5 lb. per sq. in. This size can also be worked off compressed air mains if an air-receiver fitted with escape valve is used and the pressure suitably reduced. In Messrs. Alldays & Onions' burners the oil is regulated by a needle valve, and the air by a cone valve fitted with a locking ring. The needle valve is provided with a packing gland to prevent leakage of the oil. The makers claim that with their burners perfect combustion can be obtained, consequently the minimum amount of oil burnt for a maximum amount of heat. It is possible with a correctly-constructed furnace to obtain a temperature of over 1,700 deg. C. with a proper air supply.



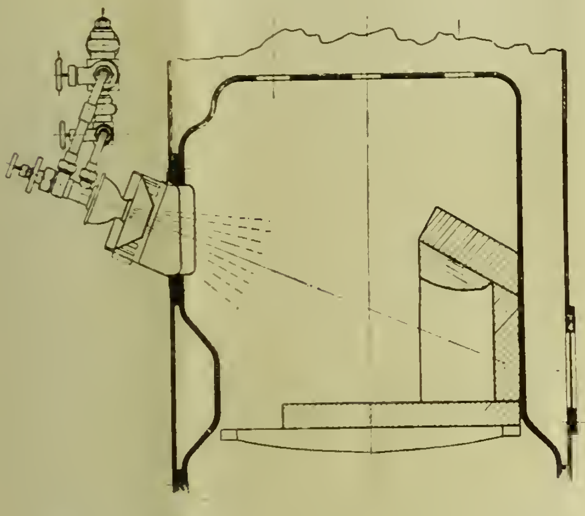
Oil Burner fitted with Blast Standard and Slide Valve.

Oil-burning Installation (steam atomising) fitted to a Lancashire boiler.

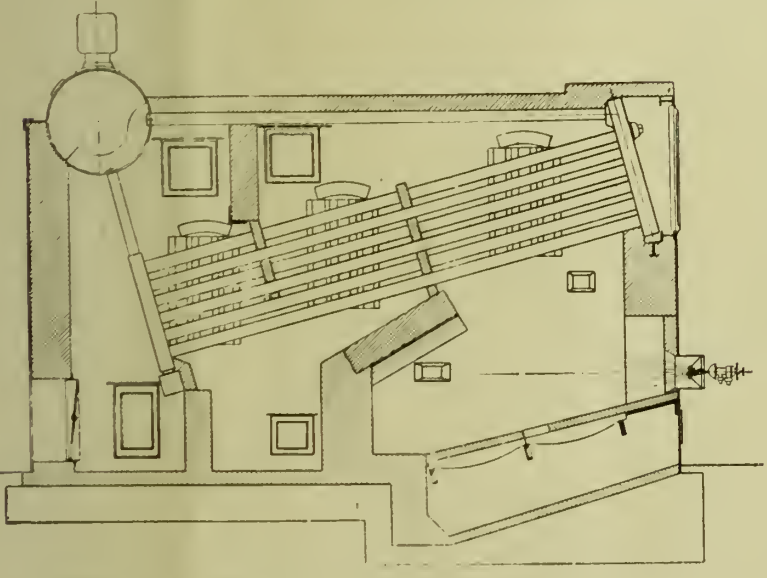
In considering which system of atomisation to adopt, it is necessary to have very complete particulars of the work for a considered opinion to be given. The gravity system first mentioned is perhaps the most self-contained, in that it can be started up without any auxiliary appliances. On the other hand, the second system is just as convenient for starting up where steam is always available from some other boiler, as on board ship. Failing this source, it is necessary to instal either a small blower to supply air (or a donkey boiler to supply steam) to the burners until pressure is raised in the boiler concerned, to enable the burners to be worked from the steam provided by the boiler on which they are fitted.

The first illustration accompanying this article shows in diagrammatic form an oil-burning installation (steam-atomising) fitted to a Lancashire boiler, from which it will be seen that the complete system for an average boiler consists of the following items:—

(1) Burner or burners. (2) Air-inducing cone and regulator. (3) Oil strainer. (4) Overhead oil tank, with sump, filter, level-gauge and drain cock. For heavy oils or exposed positions it is necessary to fit a steam coil to this tank to keep the oil perfectly fluid. (5) Power or hand pump for raising the oil from barrel or reservoir to the overhead tank. (6) Connecting pipes, swivels, and small fittings to connect up the various units.



Oil-Burner fitted to Vertical Cross Tube Boiler.



Showing application of Oil-burner to Water-tube Boiler.

In the case of an installation employing air for atomising, the above items are only slightly modified, but a blower or fan is required in addition to supply the necessary air.

BRITISH EMPIRE STEEL.

The British Empire Steel merger project, recently outlined in these columns, is meeting with opposition on the part of the directors of the Dominion Steel Corporation, who have issued a circular to their shareholders asking proxies for re-election, and drawing attention to an alleged lack of information regarding the assets of companies, other than the Dominion and Nova Scotia steel concerns, which are to enter the merger. The circular states that the shareholders are, in effect, asked to buy an interest of 51 per cent. in combined properties on values not verified by them, or to form a partnership to which they contribute 51 per cent., without being allowed to satisfy themselves as to the value of what other partners contribute. Mr. Mark Workman, the former prescident of the Dominion Steel Corporation, now in London, is also opposed to amalgamation with non-essential companies without the fullest investigation.

Howard and Bullough, Ltd., the textile machinists of Accrington, declare an Ordinary dividend of 10 per cent. for year.

THE VEGETABLE OIL INDUSTRY IN THE SHANGHAI DISTRICT.

BY VICE-CONSUL C. E. KLINE.

The principal oil-bearing seeds and nuts and other oil-yielding material produced in China are beans, cotton seed, groundnuts, rapeseed, sesamum seed, tea seed, and wood nuts (filberts). Practically all of the above products are produced by cultivation.

Oil mills are steadily on the increase in China, and the principal oils extracted are those from beans, cotton seed, groundnuts, rapeseed, sesamum seed, tea seed, and wood nuts. The industry in the northern part of China is mainly confined to soya beans, while the mills in central China produce the other varieties of oil mentioned.

There are a number of oil mills in Shanghai and vicinity, the following being the principal ones: Lih Teh Oil Mill Co. (Ltd.) (A. R. Burkill & Sons, agents); Moh Feng Bean Oil Mill (Chinese); Ta Teh Mill (Chinese), not working at present; Tung Chang Mill (Chinese); Ta Yu Mill; Tung Li Yuan Oil Mill (Chinese) in Ningpo.

The native oil press is a cumbersome wooden affair, wedge driven, by which process much of the oil is wasted. The native presses are rapidly being replaced by foreign presses, a great many being of Japanese manufacture, though there are some of English and American make.

Cottonseed mills yield an average of 45 per cent. of cake and 9 per cent. of oil. The Lih Teh Oil Mill Co., running on a per diem crushing capacity of 2,000 piculs (picul=$133\frac{1}{3}$ pounds), yields 45 per cent. of cake and 9 per cent. of oil. This mill on a 1,000-picul capacity yields 50 per cent. of cake and 9 per cent. of oil. With reference to the Tung Li Yuan Oil Mill, the machinery is Japanese, and the annual output, crushing 200,000 piculs of cotton seed, is 18,000 piculs of oil and 72,000 piculs of cake. About 50 per cent. of this is consumed locally and the remainder shipped to other ports in China. The cake is exported to the United States.

None of the cottonseed mills work all the year round, as there is not enough seed to do so, and even if sufficient seed were available the temperature during the summer causes it to heat, and the oil becomes very rancid in consequence.

The capacity of the mills mentioned above is as follows, so far as figures are available: Lih Teh Oil Mill Co. (Ltd.), 2,000 piculs per diem; Ta Yu Mill, 2,400 piculs per diem; Tung Chang, 1,000 piculs per diem. In addition to these mills there are two mills at Tungchow having a capacity of 1,700 piculs.

Practically every manufacturer and exporting firm has its own chemist. The large plants invariably have chemists whom they have employed in European or American countries. There is no Government chemist. The necessity for procuring the services of chemists has been felt by all exporters, and the matter of establishing a chemical bureau in Shanghai has been considered recently by the American Chamber of Commerce. It is extremely desirable that the chemist should have such qualifications as would entitle him to recognition in the consuming countries.

It is difficult to state what the general effect of the war has been on the oil industry. Whether the war has been the cause or not, the prices have advanced since 1915 to the present time more than 100 per cent. on wood-nut oil, and also a very large increase has been noted in prices of other oils. The demands in other parts of the world for oil products of China have been so great as to justify the increase in price, as measured in the local currency, during this period. If one takes into consideration the high rate of exchange which exists at present between China and other countries and the high value of silver generally, the present prices are five times as great as those at the beginning of the war.

Brooks and Doxey Ltd., the textile machinists of Manchester, are being wound up voluntarily for purposes of reconstruction. The new company is named Brooks and Doxey (1920), Ltd.

The directors of Ruston and Hornsbys, Ltd., of Lincoln and Grantham, announce: Dividend on the Ordinary shares at the rate of 5 per cent. per annum. To credit of employees aid account, £1,000; £11,175 to depreciation on buildings, plant and machinery; carried forward £37,240.

Anderston Foundry, Ltd., of Middlesbrough, show profit for the year, including amount brought in, £36,474; final dividend, 15s. per share (making 18s. per share for year, less tax; reserve, £10,000; carry forward, 7,574.

HEAT TREATMENT OF CARBON STEELS.

Advice was given in the April issue of this Journal on the Heat Treatment of High Speed Steels taken from an article in the "Edgar Allen News" published by Messrs. Edgar Allen & Co., Ltd., of Sheffield. The same firm now gives practical instructions on the heat treatment of carbon steels. This shows that the percentage of carbon in steel, of course, varies heat treatment procedure, also the series of purposes for which the steel may be used. Messrs. Edgar Allen state that steels with under 0.15 per cent. carbon respond to heat treatment, but to a very small degree, and all that is necessary is to normalise them at a temperature of 1,652 deg. to 1,688 deg. F. (900 deg. to 920 deg. C.). These steels are suitable for case hardening. Annealing is generally done to remove strains caused by forging or rolling at a low red heat, or by cold working, such as cold rolling or wire drawing.

Carbon steels with a percentage of carbon ranging from 0.15 per cent. to 0.25 per cent. are used chiefly in engine forgings and in the construction of motor cars. For carbon steels of this character, the best refining temperature is 1,598 deg. to 1,652 deg. F. (870 deg. to 900 deg. C.). Forgings of this steel may be normalised by heating them to the same temperature as for annealing, but allowing them to cool in the open air. An average annealing temperature, which, however, cannot be applied in every case, is 1,500 deg. F. (816 deg. C.).

Leaving over to another occasion the heat treatment of mild carbon steels, between 0.25 per cent. and 0.60 per cent., which include axle and crankshaft steels, etc., the treatment of carbon tool steels, or high carbon steel, ranging from 0.60 per cent. to 1.50 per cent., is dealt with. The object of tempering these steels is to take away the excessive brittleness of a hardened tool and to relieve hardening strains. It is effected in a simple way by knowledge of the fact that a polished steel surface oxidizes on being heated and the colour due to oxidation.

The following table shows the colours and approximate equivalent temperatures they represent:—

Colour of Oxide on Surface of Steel.	Centigrade. deg.	Fahrenheit. deg.	Suitable for
Dark Blue ...	316	600	Hand Saws
Blue	293	560	Fine Saw Blades, Augers, Boiler makers' Snaps, Chisels, Smiths' Tools and cold Sets.
Bright Blue ...	288	550	Watch Springs, Swords.
Purple	277	530	Table Knives, Large Shears, Wood Turning Tools.
Brown beginning to show Purple	266	510	Axes, Planes and Woodworking Tools.
Brown	254	490	Scissors, Shears, Cold Chisels, Large Drills, Shear Blades, Punches, and Wood Cutting Tools.
Golden Yellow ...	243	470	Penknives, Hammers, Taps. Reamers.
Straw	230	446	Razor Blades, Large Lathe Planing and Slotting Tools, Taps, Reamers, Small Drills. Screwing, Stamping and Cutting Dies, and Miners' Drills.
Pale Yellow ...	221	430	Small Edge Tools, Small Lathe Planing and Slotting Tools.

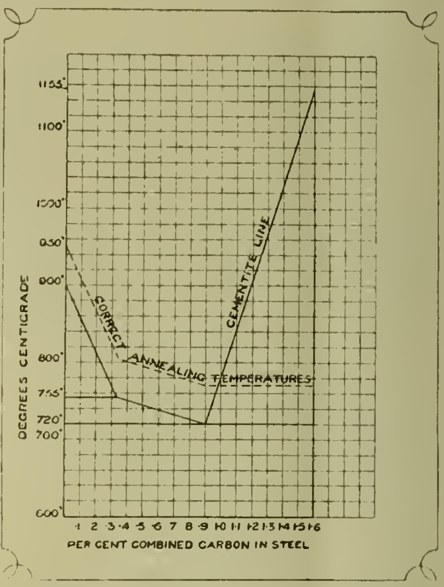
The tool is heated to the hardening heat and the cutting edge quenched in water, and quickly withdrawn so as to leave sufficient heat in the body of the tool to reheat the part to be tempered. In tempering a tool, it is usual to rub the part to be tempered with a piece of sand-stone or emery cloth, so that the surface is sufficiently clean to show the colours. When the proper colour has reached the part to be tempered, the tool is again quenched. In the case of milling-cutters, etc., the cutter can be first hardened and then warmed up on a plate till the desired colour is arrived at, and then quenched again in water.

Always reheat the piece of steel after forging for hardening. Reheat the steel as uniformly as possible for:—

Temper No. 1	1.35% C.	Temper Nos. 1 and 2 to Dull Red Heat (780°C.
Temper No. 2	1.20% C.	
Temper No. 3	1.05% C.	Temper Nos. 3 and 4 Dark Cherry Red Heat (800° C.)
Temper No. 4	0.90% C.	
Temper No. 5	0.75% C.	Temper Nos. 5 and 6 Cherry Red Heat (825° C. and quench in water
Temper No. 6	0.60% C.	

For heating and forging the steel should be heated slowly and thoroughly for Temper Nos. 1, 2 and 3, to cherry red heat (825 deg. C.), and for Temper Nos. 4, 5 and 6, to bright red heat (950 deg. C.), then forged to the shape required, and allowed to cool.

The following chart gives all the needful information concerning most annealing temperatures for carbon steels. The "Cementite line" may be ignored.



Heat Treatment of Carbon Steels.

A muffle furnace should always be used for preference, the construction of this type ensuring that top, bottom and sides are heated at the same time. An additional advantage is that neither the gases nor external air come into contact with the steel. Where, however, annealing is done in an open furnace, the hot gases should be allowed to circulate freely, so that the heat may reach the bottom and centre as well as the top of the charge. Where possible, the steel should be raised above the floor on some kind of support. This helps to distribute the heat uniformly.

Heating should be done slowly, carefully, and evenly, and the steel should not be held too long at annealing temperature.

NICKEL-PLATING OF ALUMINIUM AND ALUMINIUM ALLOYS.

Tests were recently carried out by Messrs. Guillet and Gasnior, and the results submitted to the French Academy of Sciences, to determine the possibility of obtaining satisfactory deposits of nickel on aluminium and its alloys. Another French worker has already obtained partial success by first scouring the metal in a solution of hydrochloric acid, but the resultant deposit was very uneven. The method of the two writers mentioned above consists in, first of all, sand-blasting the metal to be treated, the pressure of blast being 500 grams per sq. cm., and the sand just passing through a screen of 0.2 mm. mesh. This was followed by nickel-plating to a depth of some 6-100ths mm. The duration of the operation is half-an-hour, and the mean current-density 0.8 ampere per sq. dm. After this the nickel surface is copper-plated to a depth of 0.02 mm. for two hours, with a current-density of 1 ampere per sq. dm., the surface obtained being carefully polished. The copper surface is then coated with nickel to a depth of 0.05 mm., the operation lasting for one hour. Finally, the nickel-plated surface is polished. When this procedure is followed, the mechanical tests are satisfactory. The following were applied:—Penetration test for cracking; bending through an angle of 120 deg.; burnishing. The chemical test consisted in subjecting the nickel-plated surface to a 15 per cent. solution of NaOH at a temperature of 100 deg. C., and under these conditions the nickel-plating was found to be intact. The copper solution used in the tests in question consisted of 150 grams of copper sulphate, and 20 grams of sulphuric acid, with water to make up to 1 litre. The nickel bath was formed of 150 grams of double sulphate of nickel and ammonium and 50 grams of water, to make up to 1 litre.

MODERN ENGINEERING PRACTICE.

THE ELECTRIC PROPULSION OF SHIPS.

Progress in the electric propulsion of ships makes rapid headway, both as regards the variety of vessels being equipped for electrical propulsion, and still more so in the quantity of expert evidence and consideration on the matter forthcoming from technical societies and marine engineers generally. Amongst the electrically-propelled vessels most recently completed are three 3,000-h.p. installations by Japanese firms, some smaller repeat orders for Swedish owners, and some 40 vessels, aggregating about 70,000 h.p., are under construction, principally for Scandinavian owners. On the Thames electrically-propelled tugs, installed with Diesel engines, are being advocated. The advantages attaching to electric propulsion have on various occasions been dealt with in this journal and readers will be sufficiently acquainted with them. Many problems have, however, yet to be solved. The effect of the helm on propelling motors running at synchronous speeds is a case in point, and is being met by designing the motors to meet the virtual overload caused by the turning movements of the ship. The loss involved in transmission due to the inherent principle of converting mechanical into electrical energy and then back again to mechanical is counterbalanced by the advantages obtained in eliminating the reduction gears of the turbine. In any case, the disparity with straight mechanical drive is small. The greatest scope for the system of electric propulsion is in large vessels, although excellent economies have been shown in small vessels of the tramp type. The Diesel electric combination drive has not the attractions of a turbo-electric drive, where both turbine and alternator essentially need high speed for operating at maximum efficiency. It should be added that no electrical difficulty should arise, except that overload conditions cannot be met so readily as in the turbo-driven plant, especially when the boilers are oil-fired.

NEW METHOD OF TEMPERATURE MEASUREMENT.

A thermostatic metal has been introduced by the British Thomson-Houston Co., Ltd., of Rugby, which allows of improved practice in measuring temperatures. The special metal consists really of two metals, united firmly and permanently throughout their entire length. The two metals used have widely different co-efficients of expansion, and a bar made of them will bend with heat, and can therefore be used for making various devices, superseding in many cases the ordinary thermometer entirely. Such device gives rapid, if not instantaneous, indication in a manner that can be read at a distance. A pointer actuated by the bending of such a compound bar can be made to move over, if necessary, half an inch with 1 deg. Fah. rise in temperature. The device has the advantage that there is no glass tube to break and the reading takes not more than a second. Pyrometers using thermostatic metal for registering high temperatures can be worked at a considerable distance, as the movement can be transmitted by a rod or a Bowden wire. In addition, thermostatic metal could be used for:—(1) Liquid heat measures for all kinds of manufacturing purposes, registering from 100 to 600 deg. Fah.; (2) for electric cut-outs to replace fuses, and for devices to turn on gas or electric current for heating or lighting, or for other devices for temperature control or temperature compensation, such as oven thermometers, electric heaters, thermostats, scientific instruments, motor ignition control, battery charging control, electric signal control, computing scales, etc. Thermostatic metal is made in standard thickness, ranging from 0.015 to 0.25 in., in widths up to 6 in. and lengths up to 36 in.

PNEUMATIC TYRES ON COMMERCIAL MOTOR VEHICLES

The fitting of pneumatic tyres on commercial motor vehicles with a capacity up to 3½ tons is one of the most important movements taking place in the motor vehicle industry at the present time. The pneumatic in place of the solid tyre makes the vehicle adaptable for almost every phase of work, and also allows reductions in the cost of maintenance. In America the movement is making rapid headway. Some of the leading tyre manufacturers, building the extra large pneumatic required for commercial work, have not been able to keep abreast with demand. Although the advent of the movement started but a few years ago, approximately 135,000 motor lorries fitted with pneumatics will be delivered by manufacturers this year. This out of a total expected production of 325,000 for this year is indicative not only of the demand, but of the appreciation of this demand by the vehicle maker. Approximately 50 per cent. of all motor lorries built in 1921 will be fitted with pneumatic tyres. In Great Britain also the departure is much in favour, and progress is likely to be rapid, as manufacturers of vehicles pay more attention to the light load capacity market. The increased cost and shorter life of pneumatic compared with solid tyres is more than offset by the higher speeds rendered possible with greater mileage on a lower fuel consumption and smaller depreciation of both vehicle andf load owing to lessened vibration.

ON THE CASTING OF STEEL INGOTS.

During recent years it has gradually become recognised in the casting of steel ingots that apart from defects in ingots due to the quality of the steel itself, there are other defects due entirely to the shape of the mould and the way in which the steel is poured. Mr. S. W. Williamson, metallurgist, in charge of the casting shop of Messrs. William Beardmore & Company's Parkhead Works, recently summarised modern methods and ideals in this connection. Mr. Williamson claims that nowhere can satisfactory ingots be cast without recognition of the factors already mentioned, and particularly the efficient control of the rate of pouring. If the aperture in the nozzle in the bottom of the ladle does not alter in size, then the rate of teeming will vary as the square root of the head of metal in the ladle. Obviously an ideal nozzle will be one which opens out at such a rate as to give a uniform flow of metal from start to finish. A fireclay nozzle does not meet this requirement, as during casting it opens out at a rate which varies with the temperature, degree of oxidation, and manganese content of the steel.

IMPROVED METHOD OF ERECTING POLES.

Details are to hand of a new method of erecting poles by a combination tractor and earth-boring machine. It is claimed that this machine will bore a hole and set the pole in about eight minutes. The earth-boring machine is mounted on the frame of the tractor, which carries it over any obstacles that may be encountered in the ordinary day's travel. The poles, cross arms and insulators, etc., are all assembled beforehand, and when the spot at which the pole to be erected is reached the power from the tractor engine is switched to the earth-boring machine. This, in reality, is a giant auger which will bore a hole in the ground any size from 2 to 30 in. in diameter, and as deep as 8 ft. When the hole is bored, the steel tower in which the auger is contained is used as a crane to lift the pole and set it in position. The whole operation is expeditious, and when once it is seen at work the manual process ordinarily used seems slow and awkward.

ARC-WELDING IN STRUCTURAL WORK.

The Alloy Welding Processes Ltd., of London, whose system was recently described at length in this journal, have forwarded us particulars of a new departure in the application of arc welding in the erection of a steel factory roof, this being the first example of the use of the process on a practical scale. The factory itself is a brick building, arranged on one floor and covering an area of about 22,000 sq. ft., the roof being of the North Light type with steel trusses of 14 ft. span, supported on H-section stanchions and joists. There is a total of 93 trusses in the roof. The whole of these trusses are being assembled by "A.W.P." welding, and without the use of either rivets or bolts, and already a considerable number of the trusses are in position. The cap and base plates are welded to the stanchions, the joists are welded to the cap plates, and the completed trusses are welded on to the joists. Cleats are also welded to the top sides of the trusses to carry the timber purlines for the attachment of the roofing and glazing. In carrying out the process, a simple butt is made where possible, while all other welding is carried out by placing the faces together and welding along the edges. The nature of the weld obviously restricts its application to light forms of structural steel work, but we understand that the difficulties attending the welding of heavy members will, it is anticipated, be overcome through the experience being gained in the present application of the process. A further application of the "A.W.P." welding process is to reinforced concrete construction. The present system of "tying" members together with iron wire has many disadvantages, as the method is mechanically unsound and has practically no strength. Furthermore, a beam or girder structure assembled in this manner becomes distorted and mis-shapen unless very carefully handled, whilst the tied pieces are liable to shift when the concrete is poured into the moulds. In addition to these objections, the present method of joining bars by long hooped laps is wasteful of material. In the construction of beams and frames consisting of two or more main bars and a number of minor rods or wires placed across them, the joints may be made by a single "tack" weld. Where rods join or cross one another they are arranged to lap or lie adjacent to one another for a length of two or three inches, and a run of welding is made along the vee so formed between the rods. A girder or beam with electrically-welded reinforcements is rigid at all its joints, and can, therefore, be handled and placed in position without liability to displacement of the main or subsidiary members.

PROBLEMS IN PORT ADMINISTRATION.

The Institute of Transport has been established in Great Britain as a means of enabling various interests to take counsel together on transport matters which concern the better serving of the nation at large. Its considerations and conclusions are of interest and value to other nations, and, not least, to the Far East. This is particularly the case as regards problems of port administration, as so many developments in this connection are in hand or are foreshadowed in Far Eastern territory. The Institute urges co-operation amongst port authorities, especially in utilising more fully the talent and experience of managers upon the commercial side. There are men whose experience in port work entitles them to a seat in the Council Chamber, and to advise on points of working and management with the greatest benefit to the ports, and such men should be added to the governing bodies. On the question of constitution of ports, whilst no cast-iron system is recommended, individualism may easily be carried too far and ports eventually be managed in twenty different ways.

In the provision of new accommodation and facilities, the main problem is how to anticipate future demands without unduly taxing present users of ports. Here, Great Britain has probably done more than enough for posterity, whilst insufficient has been accomplished in the Far East. Port development should be largely governed by two factors of very great importance—the ultimate destination and the place of origin of goods handled. Successful port development must largely be governed by direction and trend of trade. Great Britain, and, indeed, most countries, can furnish instances of failures attending developments which have ignored these factors.

Another problem of to-day in the ports is that of labour-saving appliances. When normal conditions of trade are resumed, the effect of the increase in the cost of labour on international trade and the necessity for greater despatch in handling can only be successfully neutralised by a greater employment of labour-saving appliances. Yet the advances in invention of late years have not done much beyond improving the power and efficiency of cranes and conveyors. The outstanding problem is to deal more economically with a mixed cargo of, say, 10,000 tons in the vessel's hold and intended for delivery to some 300 consignees. The method adopted in London is still that of landing the whole cargo, sorting it, and then proceeding with delivery to barge, rail or car. Delivery cannot be performed at the maximum rate until the vessel has left her berth. In the new Albert Dock extension they are experimenting with a system which aims at landing on the quay, delivery from either side of the ship into the barges, and delivery from the quay to the barges all to go on at the same time. The scheme is not an original one, but it is the first time it has been applied to the largest class of cargo liner, and the belief is that the whole operation of landing and clearing an import cargo will show a considerable saving in time, though not necessarily in the direct cost of labour.

GERMAN IRON AND STEEL INDUSTRY.

The British Commercial Commissioner at Cologne has issued a short survey of the iron and steel industry in Germany, in which he discusses the effect which the shifting of the centre of gravity of iron and steel production from German to French hands may have, not only on her own steel industry, but also on her vast complexity of engineering and allied trades, including shipbuilding. The net annual reduction in steel production with which she is faced through the loss—or loss of control—of Lorraine, Luxemburg, and the Saar district are but little short of her pre-war exports of iron and steel products, and amount to about 5¾ million tons. As regards iron ores, her position is that her remaining iron-ore deposits at the present rate of consumption cannot nearly supply her requirements, and she will be obliged in future to import largely foreign ores, chiefly from Lorraine, Sweden, and Spain, and, freights permitting, from Nova Scotia. With the loss of 40 per cent. of both her pig-iron and mild-steel production, Germany is faced with a position the results of which are difficult to foresee, but, Mr. Kavanagh concludes, it is hardly possible that any regular surplus for export can remain to her.

The Metropolitan-Vickers Electrical Co., Ltd., have removed their London office from 2, Norfolk Street, Strand, London, W.C., to 4, Central Buildings, Westminster, London, S.W.1.

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PERSONALIA.

Sir William J. Pope has accepted the nomination of the Council of the Society of Chemical Industry to be President for the year 1919-1920; Professor H. Louis has been elected foreign secretary in succession to the late Dr. R. Messel, and Dr. C. C. Carpenter will succeed him as the Society's representative on the Governing Body of the Imperial College of Science and Technology. The new vice-presidents are Mr. J. Gray, Mr. D. Lloyd Howard, Dr. Stephen Miall, and Mr. E. Thompson. Four out of the following six gentlemen are to be elected ordinary members of the Council, viz., Dr. T. Howard Butler, Mr. F. H. Carr, Mr. W. H. Coleman, Dr. Cecil H. Desch, Dr. F. C. Garrett, and Mr. C. J. Goodwin.

Mr. C. Smith, of Newcastle, has been elected chairman of the directorate of the Consett Iron Co., Ltd., in succession to Mr. M. Fenwick. Mr. Smith is a director of Smith's Dock Co., Ltd., and also managing director of the firm of T. & W. Smith, Ltd., of Newcastle, wire rope manufacturers.

The death is announced of Sir Frank Martin, of Thomas Turton & Sons, Ltd., steel and file manufacturers, of Sheffield. Sir Frank was managing director of the firm for many years, and practically the whole of his business life was spent at the works.

Mr. H. S. Rowell, manager of the light engineering department of the Elswick Works of Sir W. G. Armstrong, Whitworth & Co., Ltd., has been appointed technical secretary of the Research Association of British Motor and Allied Manufacturers, Ltd.

Mr. R. S. Johnson, for many years connected with the firm of Workman, Clark & Co., Ltd., has joined the board of Cammell, Laird & Co., Ltd., and will assist Sir G. J. Carter at the Birkenhead works.

Sir Robert Hadfield, Bart., has presented the Council of the Institution of Mechanical Engineers with £200, as a prize for the description of a new and accurate method of determining the hardness of metals.

Mr. W. L. Hichens, chairman of Cammell, Laird & Co., Ltd., is mentioned as a probable member of the Imperial Shipping Committee.

Sir Reginald H. Brade has been elected a director of the Austin Motor Co., Ltd., of Birmingham.

The Hon. Sir Charles A. Parsons has been awarded the medal of the Franklin Institute.

CATALOGUES RECEIVED.

Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, forward us a copy of pamphlet No. 21 D, just issued, dealing with Peebles' self-contained continuous current dynamos and motors. This publication gives a full specification of the machines, together with quite a number of half-tone illustrations, lists of dynamo and motor ratings for each frame size for the three standard voltages mentioned, and for all five types of machines dealt with. The catalogue mentions that all these machines are fitted with commutating poles with but very few exceptions, and will run sparklessly at all loads within their capacity with fixed brush position. All ordinary requirements are covered by the five standard types dealt with, comprising protected type machines, semi- and totally enclosed types, mining type, and pipe-ventilated type motors. The makers also design machines to meet the requirements of any particular case.

From Messrs. Marshall, Sons & Co., Ltd., of Gainsborough, we have received a copy of Publication No. 1,136, illustrating and describing their steam engines and boilers supplied for oilfields power requirements and liquid fuel burning apparatus. Simplicity of manipulation and strong construction with light weight characterise the engines listed, and the boilers shown are specially designed and proportioned to work in conjunction with the engines for oil-well drilling.

Messrs. Ransomes, Sims & Jefferies, Ltd., forward a copy of their 96-page illustrated catalogue No. 7,190G, describing steam engines and machinery manufactured at their Orwell Works, Ipswich. This book deals very fully with the makers' agricultural locomotives and various types of boilers, compound portable, semi-portable, undertype and stationary engines, various types of agricultural plant, winding and hauling machinery, pumping and woodworking machinery, etc. The firm state that since the war they have adapted their aircraft factory to the manufacture of electric vehicles on a considerable scale, and that they are using other large extensions made during the war to works and equipment for the facilitated production of their leading engineering specialities for which they are now better equipped than ever before in the history of their company.

Messrs. Galloways, Ltd., of Manchester, send us two well printed and illustrated catalogues dealing respectively with their large gas engines and Uniflow steam engines.

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Benzol
Bricks (Fireclay and Silica)
Caustic Potash
Caustic Soda
Coal Tar
Copper, Acetate
Copper, Iodide
Copper, Nitrate
Copper, Sulphate
Cresols
Dry Felt Fibre
Glucose
Glycerine
Hair (Manufactured)
Lubricating Greases
Molasses
Motor Spirit
Naphthas
Naphthalenes
Oils: Anthracene
Blastfurnace Creosote
Coal Tar Creosote
Essential
Fuel
Fusel
Fish
Gas
Green
Lubricating
Paraffin
Petroleum
Oils: Whale
Paints
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Red Lead
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In both cases the letterpress comprised in the catalogues contains matter of value quite apart from the description it includes of the firm's manufactures, and the books are likely to prove of value to all who are considering these types of prime movers.

Messrs. Drake & Gorham, Ltd., of London, forward a copy of pamphlet No. 289, dealing with their "Silent Alamo" self-contained generating set for light and power. In this set the motor is of the rotating sleeve-valve type, eliminating many parts common to the poppet-valve type of motor. The machine is self-starting, and automatically stops when the batteries are fully charged. The voltage is 32.

From the General Electric Co., Ltd., we have received a copy of their H-section catalogue dealing with the firm's "Magnet" electric heating and cooking appliances, including fires, lamp radiators, convectors, kettles, sterilisers, saucepans and boilers, irons and heaters, etc.

The British Engineers' Assocation forward a copy of their current issue of "Steel Structures," the journal of the steel structural section of the Association, containing articles and data on the use of steel in house construction, information required by tendered *re* bridge work and steel frame building, conditions of sale relative to export, British standard sections, etc. The journal is well illustrated.

Leaflets are to hand from the Clydesdale Chemical Co., Ltd., of Glasgow, dealing with the firm's "Caktine" special boiler detergent and their "Bitumisol," a specially prepared bituminous solution giving a protective covering for iron, steel and wooden structures.

TRADE NOTES.

Conditions of sale relative to structural steel work for export for bridges or buildings have been standardised by the Steel Structural Section of the British Engineers' Association. They are:—(1) Prices quoted to be "net cash" unless otherwise stated; (2) If price is required for steel work only delivered f.o.b. British port, payment should be made "Cash against Shipping Documents in London"; (3) If price required for structures delivered and erected, payment should be made as follows:—80 per cent. against shipping documents, 15 per cent. monthly on the value of erected work, and balance of 5 per cent. in one month after completion of contract. Considerable time will be saved if bankers' or other suitable references are forwarded with preliminary inquiry, while all work is to be inspected and accepted at the makers' works. A specification covering materials to be used and the general construction of the work is to be submitted with the tender.

An amalgamation of interests has been arranged between the Lancashire Dynamo & Motor Co., Ltd., of Manchester, and the Crypto Electrical Co., Ltd, of London. It is intended that all machines below about 10 h.p. shall be manufactured at the London works, and that machines above this size shall be manufactured at Manchester. The Crypto Electrical Co.'s works are being extended to double their present size, which extensions are practically complete. The last accounts of the Lancashire Dynamo and Motor Co. show profit for the year, £19,937; brought forward, £4,331; disposable balance, £24,268; ordinary dividend, 10 per cent. per annum, free of tax; reserve account (making £80,000), £447; directors' fees, £1,400; carried forward, £5,542.

The British Empire Steel Corporation, dealt with in the last issue of this Journal, which it was proposed to incorporate with capital of $500,000,000 (£100,000,000), at Ottawa, has filed an application for incorporation in Halifax. The application has been accepted. The change is due in part to representations by the Government of Nova Scotia, who desired the incorporation in this Province.

The accounts of the Electric Construction Company, Ltd., of Wolverhampton, show:—Net profit, £66,169; debenture interest, £6,304; depreciation, £10,000; brought forward, £38,669; final ordinary dividend, 9 per cent. per annum, making 7½ per cent. for year; bonus, 2½ per cent., both less tax; reserve, £10,662; carried forward, £39,781.

Bolckow, Vaughan & Co., Ltd., the iron and steel manufacturers, of Middlesbrough, have acquired a controlling interest in the Darlington Rolling Mills Co., Ltd., hitherto under the sole control of Mr. G. E. Sisterson, who will remain chairman and managing director of the company.

At the annual meeting in London of the Institution of Electrical Engineers, it was announced that the membership of the Institution was now 8,217, compared with 7,023 in April, 1919. Mr. Ll. B. Atkinson has been elected President of the Institution.

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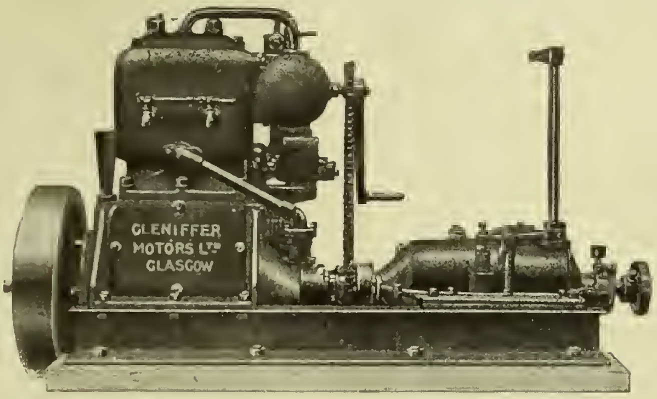

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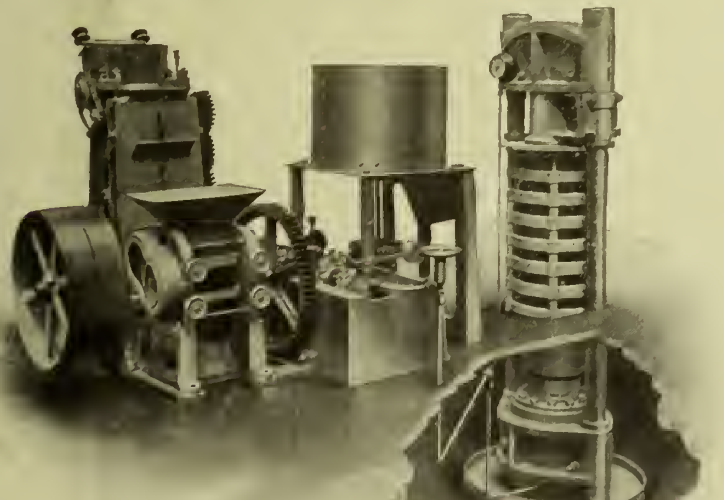

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WEIGHT 2 Tons.

This Condenser improves the Power Factor of a 300 k.W. load from ·6 to ·9, and reduces the apparent load from 500 to 333 k.V.A.

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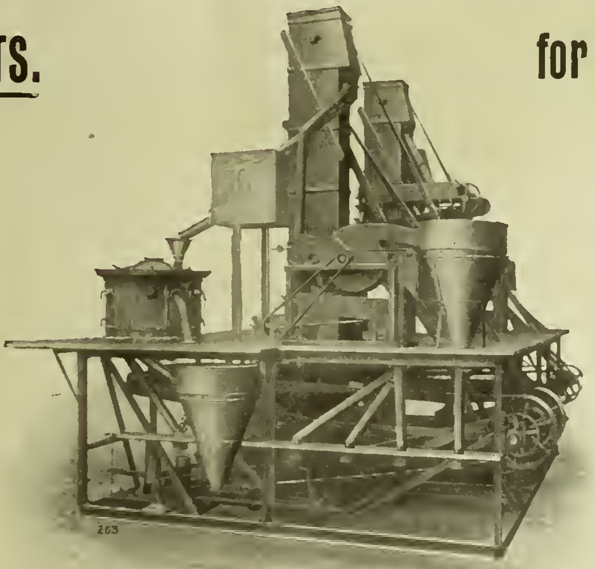

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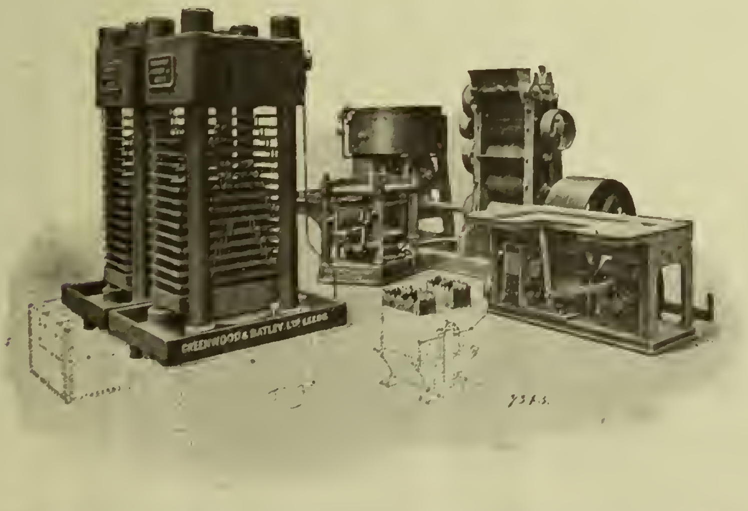

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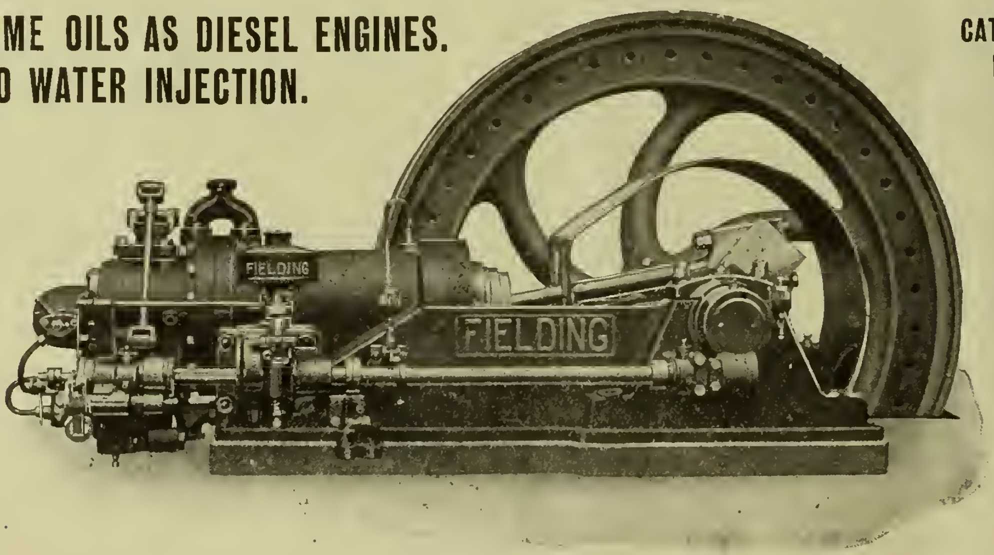

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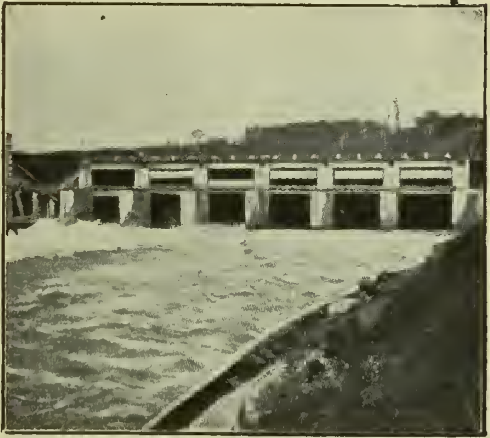

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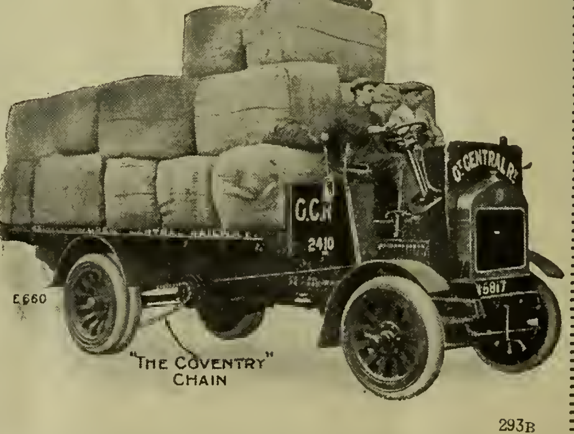

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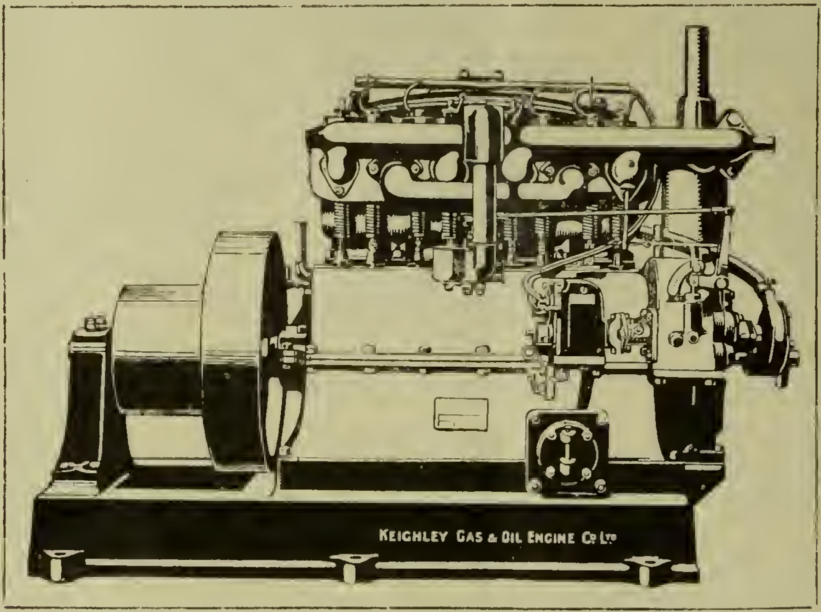

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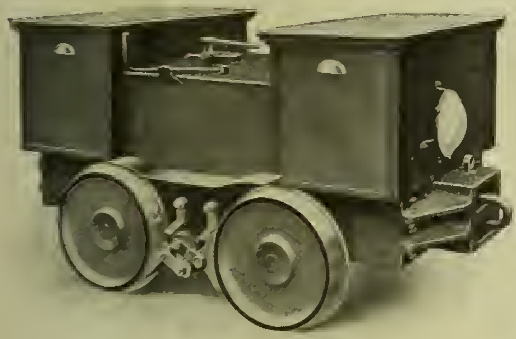

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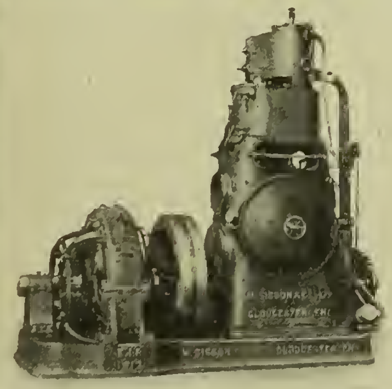

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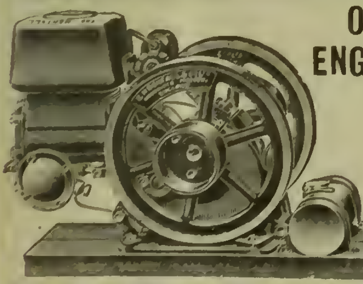

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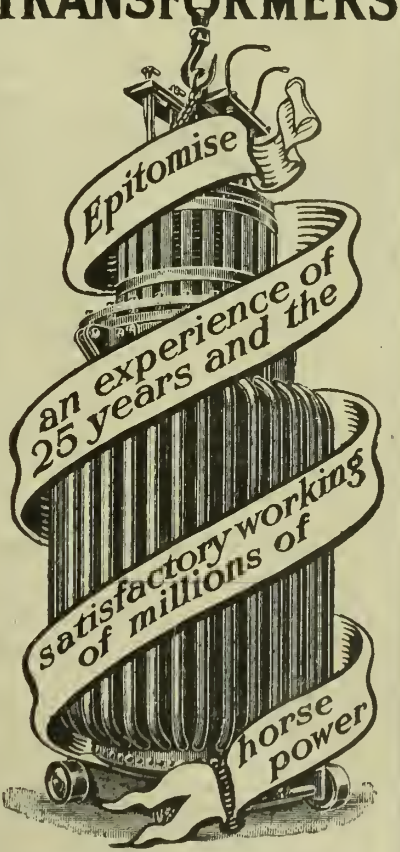

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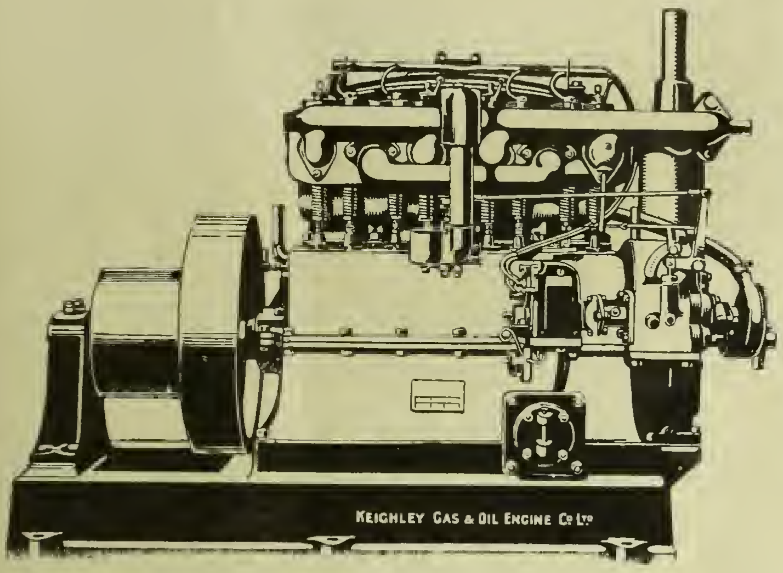
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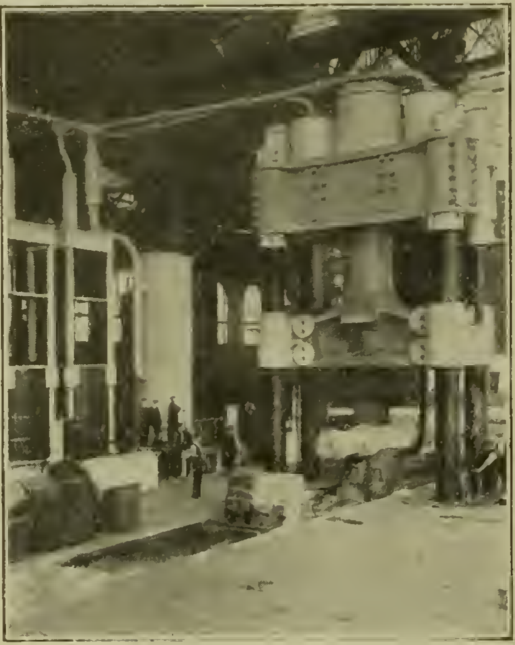

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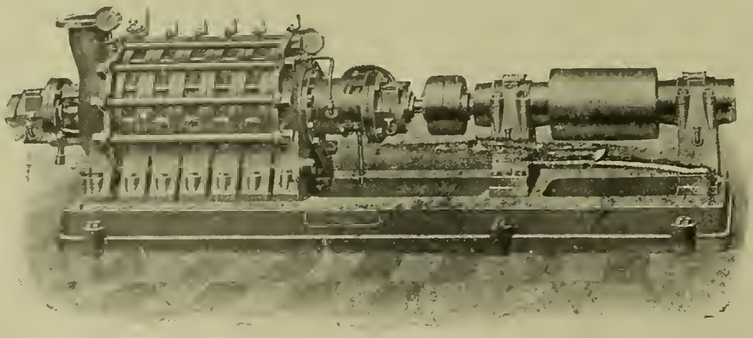

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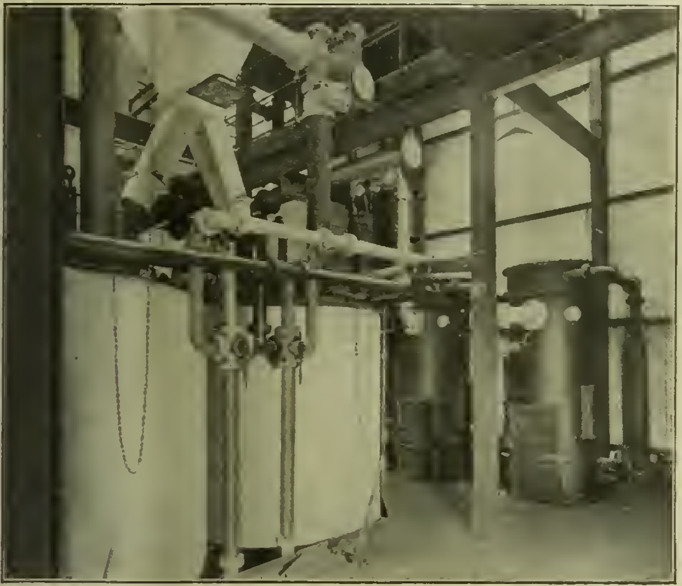

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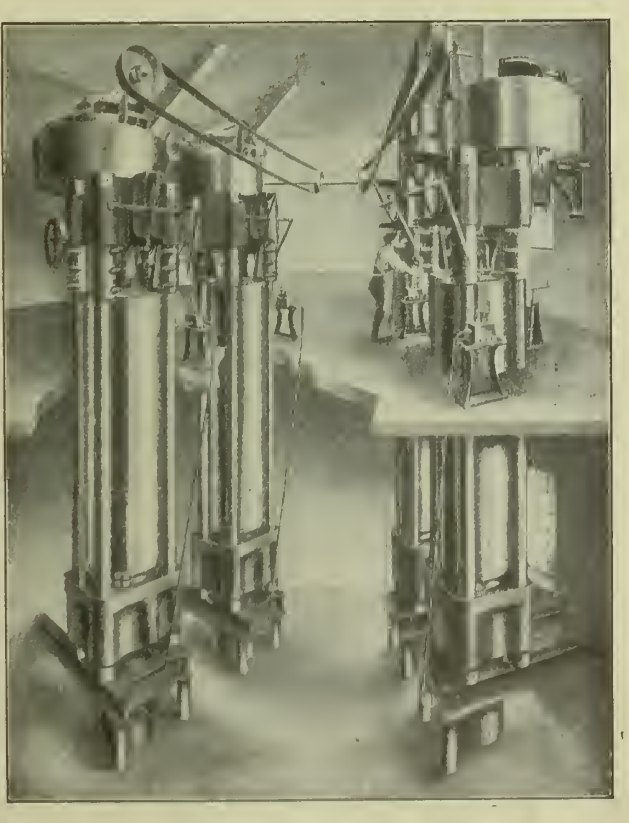

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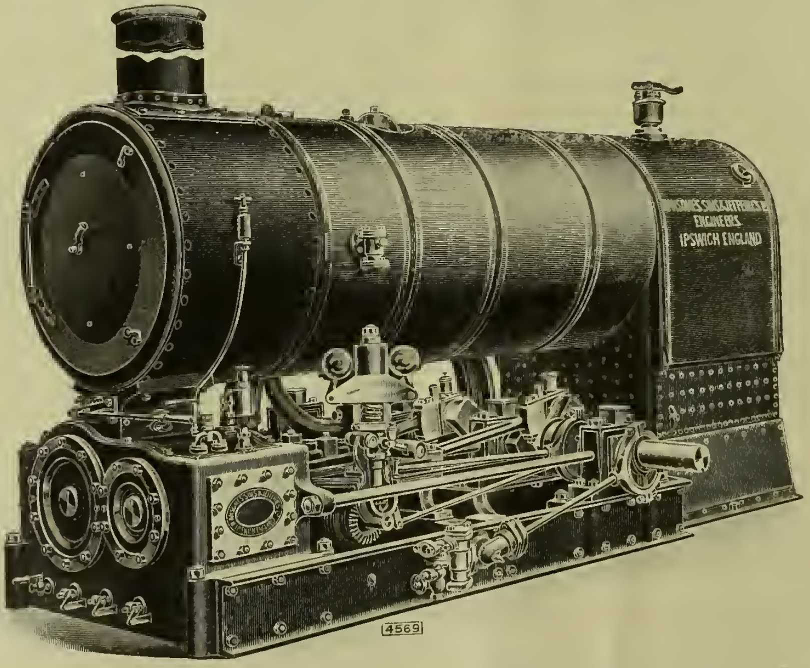
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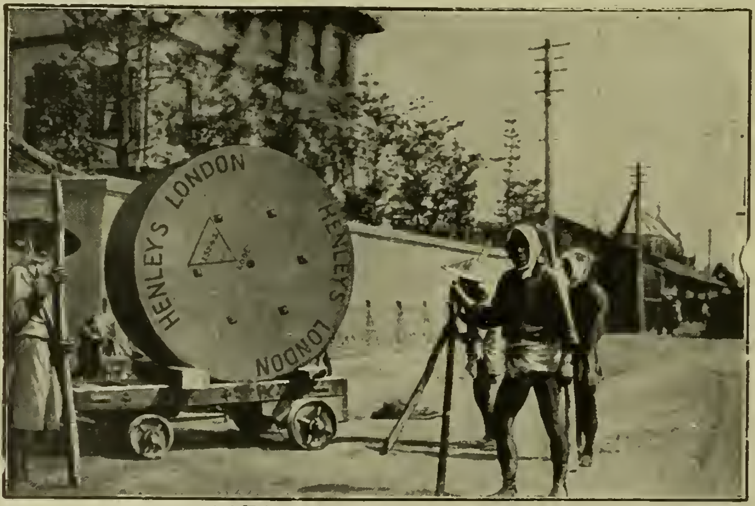

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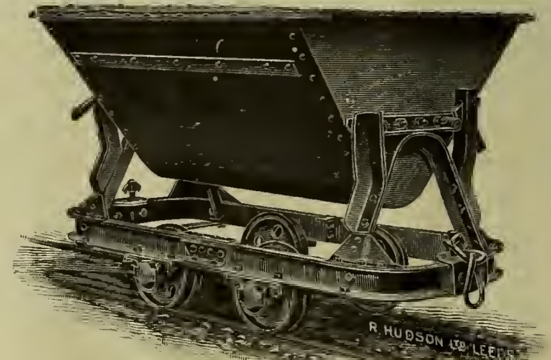

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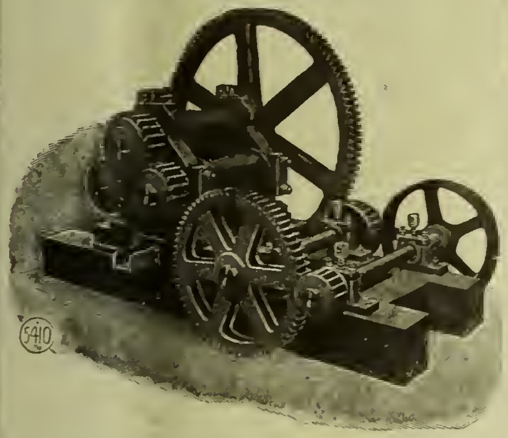

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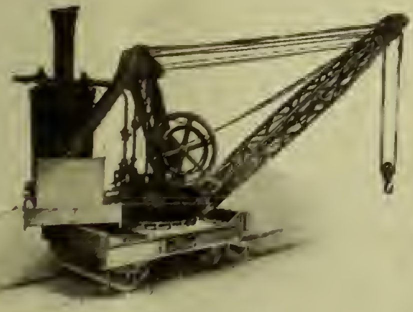

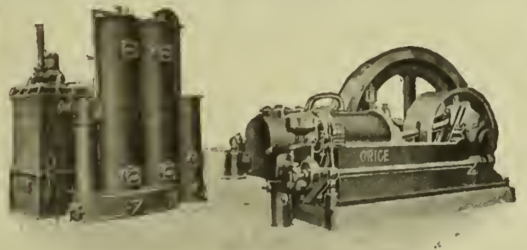

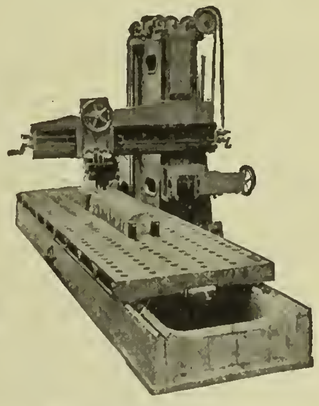

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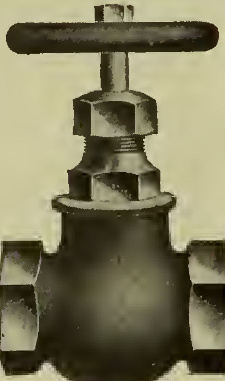

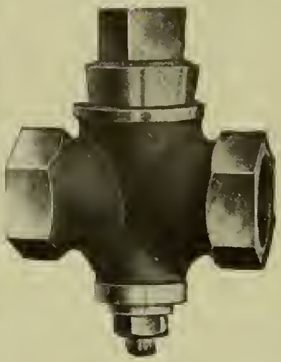

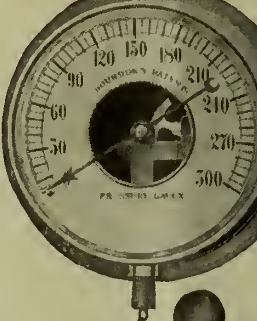

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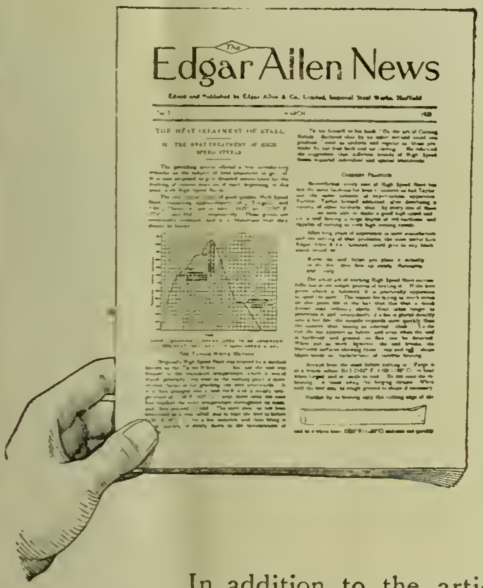

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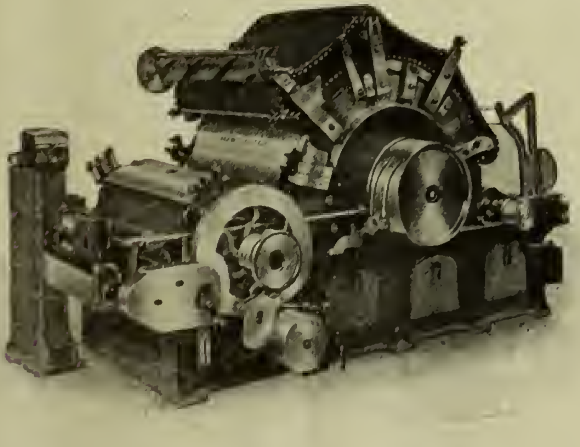

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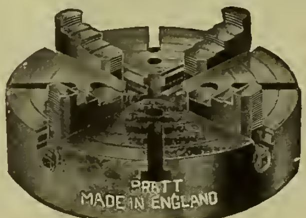

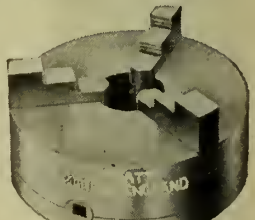

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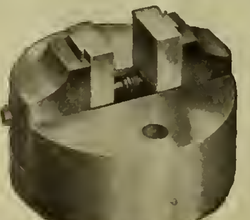

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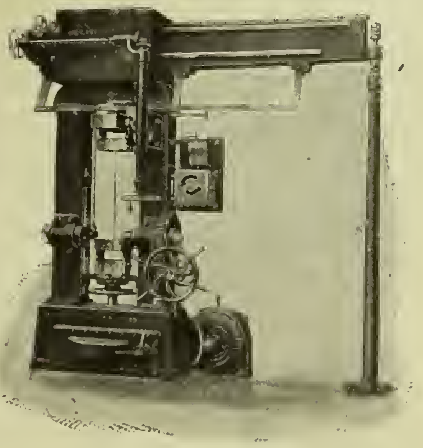

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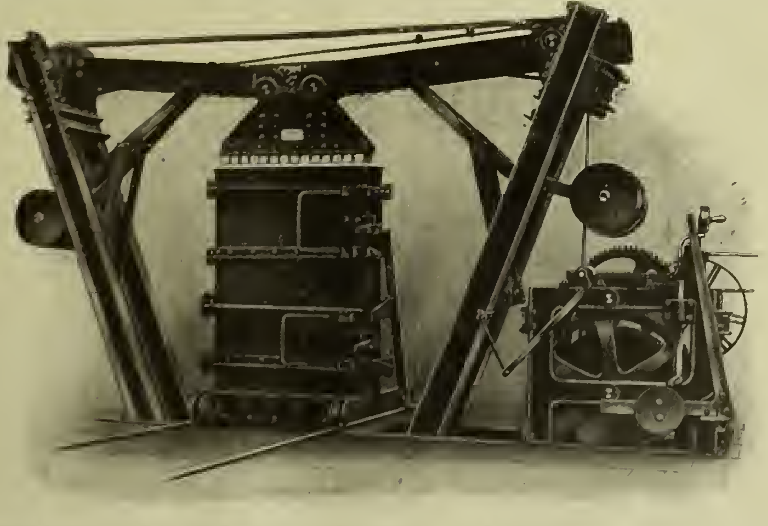

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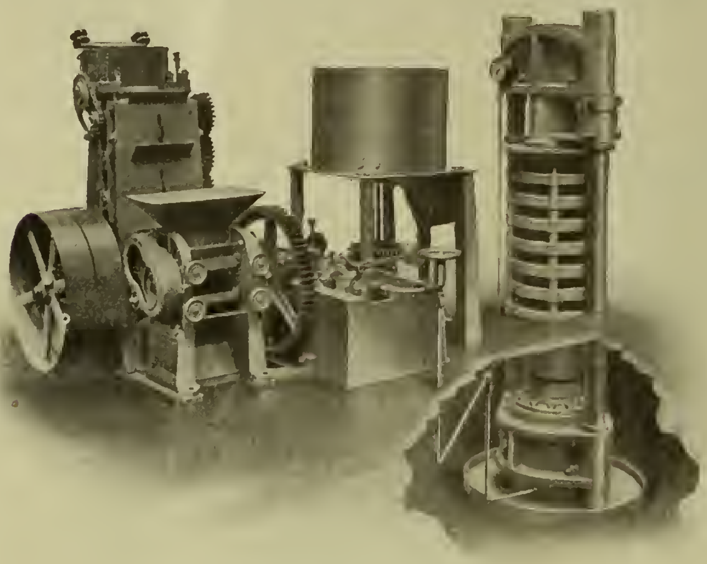

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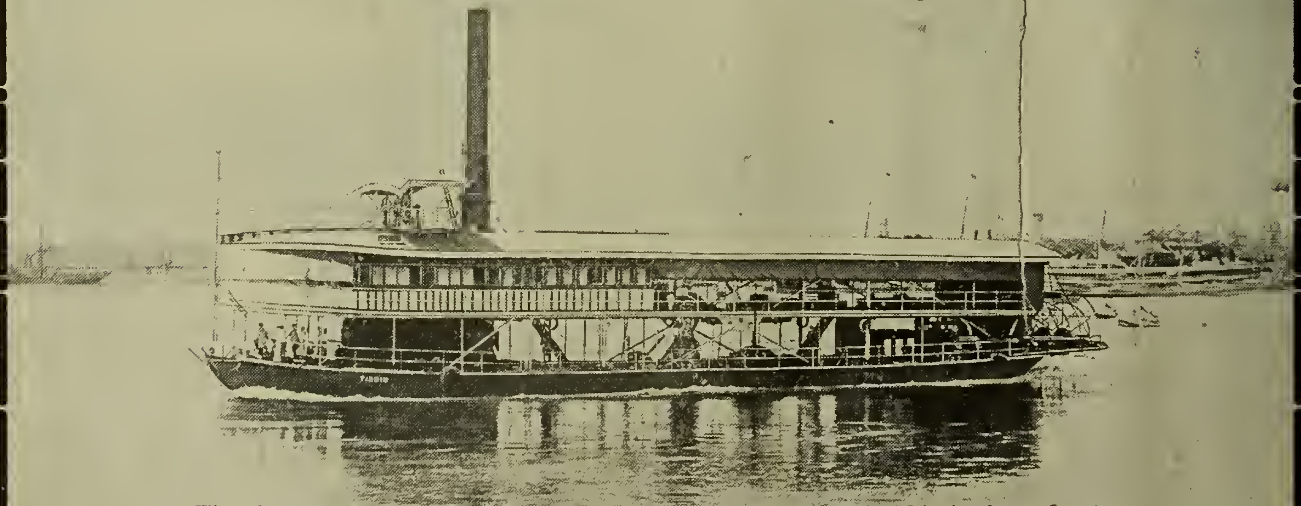

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NOTES AND COMMENTS.

INTERNATIONAL CHAMBER OF COMMERCE MEETS.

The first Congress of the International Chamber of Commerce, the formation of which institution was outlined in our May issue, just held in Paris, shows that the high estimates made of its usefulness were well founded. The speeches delivered are calculated to facilitate commercial understanding and co-operation between nations, and the Chamber appears to be well constituted to carry on its international work. The authoritative opinion offered at the Congress that America may well become a country exporting no cereals and, for the present, little cotton, whilst it will serve as a warning to some countries, should be taken as a stimulus to agriculture in the Far East and to China particularly—a country which has received so many indications during the past few years as to the immense markets for its produce developing abroad. The Chamber recommended the establishment of a central bureau of international statistics charged with collecting, centralising, and analysing data for the use of the business world. In order to improve the world's state of production, to re-establish the economic balance, and to ensure peace on a permanent basis, the Congress considers it the first duty of all producers to increase by every possible means the production of the raw materials necessary for world economic policy. In furtherance of their efforts a general meeting was decided upon for the creation of a statistical bureau, the duty of which would be to keep up-to-date returns of chief products, particulars as to output and probable needs, together with the movement of exports and imports of each country. All countries were exhorted, in order to increase the world's stocks, to hasten the utilisation of hydro-electric power and the carrying out of measures which tend to the extraction and use of mineral fuel in the most scientific and economic way. According to representatives at the Congress, most nations to-day have definite and special requiremens. France asks for coal, Italy for raw materials at a fair price, Great Britain pleads for relief from excessive taxation, and America seeks strength in the reaction period that follows the hysteria of excessive demand. But all the speakers expressed confidence in the future, and the work carried on by the International Chamber will do not a little to show that such confidence is justified.

LOSSES FROM STRIKES.

Statistics to hand from America set out some of the heavy losses that country has sustained in recent strikes. Labour and Capital have both been hit, and a consideration of the figures may well give reason for thought in industrial circles in the Far East, where labour troubles are being organised or are at least foreshadowed. In 1919 labour in the States lost nearly $725,000,000 and industry about $1,500,000,000. The production of bituminous coal decreased 130,000,000 tons and anthracite 12,000,000 tons; 9,000,000 tons less of steel ingots; 5,000,000 fewer cotton bales than 1914; 76,000,000 bushels less wheat than 1915; 140,000,000 bushels less corn than 1917; $10,000,000 less gold and $5,000,000 less silver than in 1918. The State of Pennsylvania alone lost some 4,655,118 working days last year, and has had some very fair strikes since. Idleness caused by the rail strike produced a daily loss of about $3,000,000 in only the Pittsburgh district. Farm labour supply (according to the Secretary of Agriculture) is 72 per cent. normal, compared with 84 last year. This will grow more pronounced, and will result in greater acreage in grass and other cheap crops demanding the minimum of labour. In chief American cities " help wanted " to " employment wanted " advertisements are in the ratio of 15 to 1. Perhaps the most sobering influence that can be brought to bear on labour troubles is found in the contemplation of the depreciations such troubles have wrought.

INDIA'S OIL SEED INDUSTRY.

It may be remembered that in 1916 the Government appointed Special Committees to deal with the possibilities of increasing and developing the trade in Indian raw materials with the United Kingdom and other countries of the Empire. The report of the Committee dealing with oilseeds has now been issued. It will be of interest and value to those in the Far East concerned with vegetable oilseeds and products, as what is done in the industry in and for India must directly affect the industry in the Far East. The great value of India's trade in oilseeds is not generally realised, in spite of the fact that the production in India is probably well over 5,000,000 tons in quantity and £50,000,000 in value per annum. The exports of oilseeds from India in 1913-1914 amounted to nearly 1,600,000 tons, valued at approximately £17,000,000. To this there must be added an export of about 3,250,000 gallons of oil, valued at nearly £400,000, and an export of nearly 200,000 tons of oil-cake, worth about £1,000,000. The annual value of the export trade of India in oilseeds and their products may therefore be placed at about £18,500,000, taking 1913-14 as an average year. According to the offical Indian Trade Returns, about one-third by weight of the oilseeds exported from India in 1913-14 was sent to the United Kingdom, but only a little more than one-fifth by value, the principal items in the United Kingdom imports being the relatively cheap seeds—linseed and cotton-seed. About one-quarter by weight of the exports in the same year, but about one-third by value, went to France, the chief items exported to France being ground nuts and linseed. Germany's share of the exports in the same year amounted to about one-eighth by weight, but about one-sixth by value, the chief items being the relatively valuable seeds—copra, mowra, and sesame—followed by rape-seed and linseed. The other countries which in 1913-14 shared to a considerable extent in India's exports of oilseeds were Belgium (chiefly linseed and rape-seed), Italy (largely linseed and sesame-seed), and Austria-Hungary (chiefly sesame and ground nuts). Between them these six countries absorbed 1,500,000 tons out of 1,600,000 tons of oil-seeds exported from India in that year, and the first four divided among them no less than 1,380,000 tons. Endeavours are being made to secure a larger proportion of India's output of oilseeds being used in Great Britain, particularly in seeds other than linseed and cotton, so that the value of the trade may more nearly approach its volume.

PROMOTING CIVIL AVIATION.

The news that the Advisory Committee on Civil Aviation in Great Britain recommends that financial assistance be given by the Government to companies operating on approved routes with aircraft of British manufacture and with British engines marks a decided step forward, inasmuch as it encourages expansion, and expansion is what is required more than anything at the present time. Any measure calculated, as the present measure undoubtedly is, to assist development is to be welcomed in every country where there is a future for commercial aviation opening up to British enterprise. The assistance recommended is not very considerable. It is limited to a maximum of £250,000 within the two financial years 1920-1922, and provides for payments to operating companies on a basis of 25 per cent. of the total certified gross revenue of each company. The reasons which induced the Committee to make the recommendation are that the existence of a healthy civil transport industry would tend to ensure the supply of material to the Royal Air Force and to reduce the cost. Conversely, the lack of development of aerial transport would entail a manufacturing industry supported almost exclusively by Government orders. The Committee considers that it is in the interests of the community to speed up communication between Great Britain and other countries and to outlying parts of the Empire, and this object will be obtained by the development of civil aviation. We believe that the measure will prove satisfactory in the working: that it will lead to other proposals and to an extension of the principle of State assistance. In a Minority Report it is urged that the money should be used for subsidies for design and research and for placing orders for experimental machines, but it is generally held that such important work can and will be better carried out by other methods than by the aid of Government financial assistance, which, however helpful as an encouragement to civil aviation, would, on the present scale, be insufficient if applied to research and experimental work.

PROGRESS IN THE TINPLATE INDUSTRY.

For some time past the manufacture of tinplate in the Far East has been considered not only a possible, but also a sound, commercial proposition. Those who have entertained this view will receive a good deal of moral support from the importance which is attached in the Welsh tinplate trade to Japanese and foreign competition generally. With the demand for tinplate continually increasing in Japan, that country has the best guarantee of success in developing the industry. Time, however, must elapse before that success is at all general, and considerable cost must be incurred. This is the experience of other countries which have taken up the industry. In Australia, where tinplate is mainly required for canning meat and fruit, the cost of the tin container has often been more than the value of the contents, but Australia has been wise in making provisions for meeting her own domestic needs of tinplates with greater certainty and ultimately at less cost than importing supplies. One of the chief difficulties in the development of the industry in Japan, and, indeed, in every country where the trade is conducted, is the shortage of skilled labour. Success or lack of success largely depends on the solution of this problem. The industry in America rapidly achieved success because America was able at a critical time to obtain a large amount of skilled labour from Wales. Conditions have changed since then, and even the Welsh trade reports labour difficulties and shortage. Machinery has been vainly sought to relieve the strenuous labour of the mill worker, but the best that modern practice can devise is to double-man the mills with the object of making it more possible for the millman to withstand the strain. In certain directions improved machinery does exist, as, for instance, the Thomas and Davies automatic combined feeding, pickling, and finishing machine, and such machinery must be installed if a full measure of success is to be achieved. At the same time, the call for skilled labour is imperative, and we do not doubt that Japan will meet the need satisfactorily. Most of the imports into Japan during recent years have come from America, from which country 65,000 lbs. were imported in 1916, although subsequent years showed a decrease due to the war. International competition will probably be keen in this industry, as not only Japan, but France, Canada, India, and Australia are either entering the trade or arranging to increase their output, and Welsh tinplate manufacturers may be trusted to use initiative and endeavour to retain their position.

MEETING FOREIGN COMPETITION.

For some time past the Board of Trade in London, through its Department of Overseas Trade, has collected samples of goods required in and supplied to foreign countries, and has submitted them to British manufacturers in order that the latter may learn exactly what their foreign customers require and the nature of the competition British manufacturers have to meet. Such samples have, however, not always been well selected, and an important innovation has now been decided upon. In future collections abroad the representative trade association of each industry in Great Britain will first of all be consulted, its opinion invited as to the class of samples that would prove most useful, and its wishes obtained respecting the particular markets abroad from which it would be best to obtain the samples. A *questionnaire* will also be sent to all Commercial Secretaries, Trade Commissioners, Consuls, etc., who are being instructed to purchase samples, and the advice and opinion of the trade associations will be obtained as to the most suitable form that this *questionnaire* should take. When replies and samples have been received, the whole information, together with samples, will be available for the particular industry interested. This new measure will apply to all industries, and the co-operation of British interests abroad is invited so that the sample exhibitions may have real practical value. In this direction Consuls and Trade Commissioners in the Far East and abroad generally have a valuable task allotted to them, but their work may be more easily and efficiently performed if industrial and commercial circles assist. In the past it has frequently been urged that the British manufacturer was often ignorant of the requirements of foreign markets and of what his foreign competitors were doing. In the future there can be little justification for such a condition.

ELIMINATING INEFFICIENCY IN INDUSTRY.

At the end of the war the Industrial Fatigue Research Board was initiated in Great Britain through the co-operation of the Medical Research Council and the Department of Scientific and Industrial Research. Its terms of reference were to consider and investigate the relations of the hours of labour and conditions of employment to production of fatigue, having regard to industrial efficiency and preservation of health. The Board's first report has just been issued. This naturally deals with the scope of the work to be undertaken, and the lines upon which its labours will be pursued; with the measure of co-operation assured or anticipated from other nations, and the results which may be expected to accrue from these inquiries. Beyond all question great benefit will be derived from the Board's investigations, and its work is of direct importance to industrial centres throughout the world. A good deal of criticism is from time to time levelled against industrial methods in the Far East, and, for the most part, satisfactory methods have yet to obtain in this part of the world. It is unnecessary—and, indeed, it would be folly—that progress should be obtained in the slow and costly manner other countries have followed in the past. The new light on industry which the Industrial Fatigue Research Board will shed will show a short cut to efficiency. More than that, it will prove that the cost of obtaining such efficiency is a sound business investment. The interest and sympathy of employers are, therefore, solicited in what ultimately is their own best interests, as tending greatly to increase the working capacity of their businesses. Industries especially open to harmful conditions are being investigated first. British and American bodies are working together, and interchanging results and ideas, and many large industrial concerns are helping greatly. The work is, indeed, international. Time must elapse before sufficient data is available to enable reliable conclusions to be drawn, and the results will be hastened, as all-round co-operation is secured.

CONDITIONS IN THE ELECTRICAL TRADE

At the general meeting, just held in Berlin, of the Central Syndicate of the Electrotechnical Industry, the fact was ventilated that the membership comprises 388 firms, employing approximately 240,000 workers and officials. This indicates that most of the electrical firms in Germany have joined the syndicate. The importance of this fact can be more accurately estimated in conjunction with the statement made that the importance of German production as a whole will secure German firms a joint influence in the development of the world's market prices, and that, as a united branch, the electrical industry is very probably able to co-determine the foreign market at the present time. The wording of this statement may be vague and its meaning a little nebulous, but it has come as a needed reminder to electrical engineering circles in Great Britain of German enterprise. In the Far East also importance will be attached to the anticipations held in Berlin. At the meeting above referred to it was also asserted that the exports of electrical manufactures, which in 1919 represented 25 per cent. of the volume in 1913 before the war, had since risen to 40 per cent. during the present year. Raw material in Germany is becoming more plentiful, and wages, with costs of coal, iron, and steel, are slightly lower than in certain other countries. Other factors, however, are maintaining the present high costs of the finished article in home markets, but will not hinder Germany developing her export trade. With competition also from Japan and America, the position calls for special enterprise on the part of those advocating British interests. The latter are, perhaps, too apt to under-estimate Japan's ability and manufacturing capacity. In their belief that Japan can supply only light, cheap goods, they may fail to realise the good progress Japan is making in heavier and more important products.

IMPROVED TRADE MARKS REGULATIONS.

The report of the Merchandise Marks Committee, appointed in London by the Board of Trade, has been issued as a White Paper (Cmd. 760). The Committee were to inquire into, and to report upon, the following questions:—(1) Whether any extension of amendment of the Merchandise Marks Act was required in respect of the provisions relating to indications of origin; (2) the utility and effect of National Trade "Marks" or other similar (collective) marks, and how far they should be authorised or encouraged in Great Britain; (3) how far further international action might be necessary for the purpose of preventing the false marking of goods. The following is an abridged summary of their recommendations as regards indications of origin:—

(1) The Board of Trade should have power to make an Order requiring indications of origin to be given in the case of any particular class of imported goods, including power to specify the form of, the manner in which, and the occasion when such indication is to be given, to prevent unfair competition.

(2) All indications, oral, documentary or other, whether physically attached to goods or not, including statements in advertisements or catalogues, and false indications given by trade names or titles of firms or companies, which are reasonably calculated to lead a purchaser to a false belief as to the origin of the goods, should be brought within the scope of the Act.

(3) Recognised national emblems should be regarded *prima facie* as indications of national origin.

(4) Attempts to forge a trade mark, apply a false trade description to goods, etc., should be brought within the scope of the Act.

(5) Local authorities should be authorised to act for the detection and prosecution of offences; and any person, association, or organisation should be allowed to prosecute on behalf of a trade or person aggrieved.

(6) Power should be given to the High Court to deal with all questions under the Act by way of injunction or declaration, and any person, town, district, etc., aggrieved by the offence should have the right to recover any damages sustained.

(7) The expression "trade mark" for the purposes of the Act should be defined.

(8) No trade mark on the United Kingdom Register should be allowed to be transferred to foreigners without the consent of the Registrar of Trade Marks.

(9) The scope of the phrase "All such goods" (i.e., goods bearing a forged trade mark, a false trade description, etc.), should be made clear in Section 16 of the present Act, which prohibits their importation.

(10) A name which is identical with, or a colourable imitation of, the name of a place in the United Kingdom, appearing upon imported goods, should be required to be qualified.

(11) Section 18 of the present Act should be re-drafted to exempt from the penal provisions of the Act all conventional and generic descriptions honestly and generally used and understood as such.

(12) In the absence of agreement among the bulk of the traders concerned, there are grave objections to the institution of a British national or Empire mark.

As to further international action, the Committee recommend that "where a country fails to carry out its obligations under a Convention and representations to the foreign Government concerned have proved ineffectual, the matter might be referred to the League of Nations or to the Permanent Court of International Justice to be set up under the Covenant of the League."

The Committee are also of opinion that there should be established in each foreign country, and at each important centre if necessary, official or trade representatives who should be in a position to bring proceedings on behalf of British nationals.

We regret to record the death, at the age of 83 years, of Mr. Henry Greenwood, a director of Greenwood and Batley, Ltd., of Leeds.

ENGINEERING, MINING AND INDUSTRIAL PROJECTS IN THE FAR EAST.

TRADE DEVELOPMENTS IN SZECHUEN.

American commercial interests are now entering the trade of Szechuen, a United States concern having purchased one of the Standard Oil Co.'s vessels running between Ichang and Chungking for the conveyance of general cargo. Of course, the Standard Oil Co. has for a considerable period had its own steamers running between the centres named, but no American firm concerned with general trade has hitherto seen fit to engage in business in this particular territory. In addition, a trading concern in Hankow has placed an order for a special type of steamer for this service with a firm on the Clyde, on behalf of Chinese purchasers. Negotiations are in progress with the representatives of other United Kingdom shipbuilding firms for two more steamers, all for Chinese interests. Benefit is anticipated to accrue to the territory concerned from this increased competition and its industrial development materially hastened.

RAILWAY AND TRAMWAY PROJECTS.

For some time past the Tientsin-Pukow Railway has had under consideration the construction of a train ferry at Pukow. The cost of this project, including railway approaches, is now estimated at $3,500,000. In addition, it has been suggested that the P'u-Hsin Railway, when built, should be continued beyond Hsin Yang Chou to Fan-ch'eng (Siang-yang Fu) in Hupei, and up the Han River Valley to Hsing-an Fu, and thence direct to Chengtu, thus avoiding the mountainous Ichang-Chengtu route. This would, of course, give a great impetus to the prosperity of Pukow. A company, with a capital of $300,000, is being formed by two native capitalists for the purpose of establishing motor-car and electric tramway roads, and it is proposed, in the first place, to lay rails from Hsuchow to Hsiao Hsien on the west, and to Su-ch'ien Hsien on the east.

MOTOR BUS SERVICES IN SHANGHAI.

Once again the suggestion of installing a service of motor buses in Shanghai is receiving consideration. That on this occasion the suggestion should have come from American sources may well be an indication that active endeavour will be made to carry the matter to fruition. The scheme has received a good deal of fairly favourable comment in the Press, and if it is accorded advocacy in proper quarters the project may quickly be put on a practical footing. The suggestion is beginning to attract some little attention amongst manufacturers of motor vehicles in Great Britain, and their co-operation may well be solicited, perhaps in helping to finance as well as in equipping the scheme. The attitude of the latter towards motor traction in the Far East is, and has been for a number of years, that the position is full of potentialities, but that it is hardly yet ripe for systematic exploitation. This attitude could be corrected if a scheme such as that brought forward in Shanghai for the regular service of motor buses were brought to a head and contracts placed in British hands. If the matter could be arranged on these lines, Shanghai would secure the most suitable vehicles it is possible to obtain, and the British motor industry would gain an advertisement in the Far East of the very greatest value.

STREET IMPROVEMENTS IN CANTON.

The Kwangtung Tram Company have decided to lend the Canton Municipality $400,000 for the purpose of providing more main streets and the compensation of property owners in connection therewith. Canton is to have a motor bus service shortly, run apparently by the company which is to provide the tramway, as a considerable time must elapse before the new tramway service can be opened.

FRENCH AEROPLANES FOR CHINA.

It is stated from Paris that the Under-Secretariat of State for Aeronautics has for some time been occupied with the question of the future of French aeroplane constructors in China, whose case has been ably set forth by Capt. Roques, Air Attaché at Peking, and M. Ricou, who is anxious to establish regular air services in China. The Government now announces that it is ready to aid French constructors, through the intermediary of the Société Nationale Aéronautique, by selling them material now in China which was originally intended for Russia. Two French companies, the Economic Organisation Bureau and the Compagnie Franco-Colombienne, are studying the possibility of sending representatives to China, and two other firms are contemplating the sale of machines to Chinese enterprises.

CHINESE GOVERNMENT RAILWAY STANDARDISATION.

As announced some time back in these pages, a Commission is shortly being organised to consider the question of standardising the Government-owned railways in China. M. Painleve, who was recently appointed Advisory Director-General of the Chinese Government railways, is the chairman of the Commission, and will be assisted by advisers selected from the nations concerned.

COLLIERY PLANT FOR CHINA.

Arrangements, it is announced, have been made for the supply by German manufacturers of all the necessary plant and machinery for a colliery which is being opened up in the Province of Chekiang, near Hangchow. The German engineer who is to superintend the installation of the plant has already arrived, and it is understood that the machinery is now on its way. The engineer was formerly employed by the Chinese Government, and was repatriated when the Germans were sent back to Germany.

INCREASED WIRELESS COMMUNICATION WITH PEKING.

Work should by now have been commenced on the erection of the wireless stations in the interior of China, to enable communications to be kept in future between Peking and her distant provinces. Constructional work was to begin this summer upon the installation of a wireless apparatus at Urga, and of another at Kashgar, in Chinese Turkestan. Before these two stations are completed, those planned for Kobdo and Hami, the former in Mongolia and the latter in Chinese Turkestan, and for Sian-fu, in Stenzi (Mongolia), will have come into existance, and in a short time Peking will be in touch with the remotest parts of her distant provinces.

GREATER RICE PRODUCTION.

Wherever conditions in the Far East favour rice cultivation more or less important schemes are in hand for greatly increasing production. The principal projects have already been dealt with in these pages, but particulars of smaller schemes frequently come to hand. Such developments, of course, foreshadow a very much increased demand for machinery and equipment, and it is satisfactory to learn that the leading British makers of rice milling plant and their representatives in the Far East appreciate the position. The General Association of Rubber Planters on the East Coast of Sumatra have obtained 10,000 hectares (25,000 acres) situated in the Province of Adhin, on a lease for twenty years, for the purpose of growing rice for the estate coolies. Similar plans are being considered by other large industrial concerns who are considerable employers of native labour. The Philippine Government has planned to spend 50,000,000 pesos on irrigation proposals for the purpose of increasing rice production to twice its present output, making the islands self-supporting and providing a surplus quantity for export. The Department of Agriculture in the Philippines is utilising the cinema to demonstrate approved methods of cultivation, preparation of seed, use of farm machinery, harvesting and storing crops, and packing and handling where these processes are involved.

OIL PALM CULTIVATION IN SUMATRA.

The Amsterdam Rubber Co. have bought the oil palm estate of Poeloe Radja in Asahan (Sumatra) from the Société Anonyme des Huiles, and also some grants in the Simoeloengoen district. There are already some 2,724 acres of Poeloe Radja under cultivation, and an area of 3,000 still available. This is the first Dutch company to start the cultivation of the oil palm on such a large scale.

MARKET DEVELOPING FOR MODERN AGRICULTURAL MACHINERY.

Very general publicity is being given to recent trials with a tractor plough on an estate free of jungle near Medan, Sumatra. Over twenty acres were turned up in about five hours, which would have taken 100 coolies one working day to perform. From all points of view the trial is claimed as a success, and the results obtained should do much to aid the greater use of modern agricultural machinery. Such machinery can with great advantage be employed on tobacco plantations. In many instances it should be possible to use the tractor plough of suitable design on rubber estates to break up the soil between the rows of trees if sufficient care be taken to avoid damage to the tree roots which are close to the surface. In the matter of clearing jungle there is a very wide field for the employment of more modern methods. Some degree of success has been made with the use of hand stump pullers, tractors for pulling out stumps, and machinery for pulling down trees. On one estate in Sumatra a portable sawmill has been installed to saw up the fallen trees, and has met with success. Crude-oil engines are preferable to and cheaper than other types of prime movers, and a good demand for these is anticipated for agricultural work. As frequently pointed out in these pages, methods and conditions in agriculture in the Far East are changing, and as a consequence the market for modern equipment is steadily developing.

RAILWAY AND PORT DEVELOPMENT IN THE DUTCH INDIES.

The doubling of the railway line in Java from Maos to Djokjakarta is announced in the Bulletin of the Federation of British Industries. It is also understood that the representative of the Baldwin locomotives has been invited to submit offers for locomotives burning liquid fuel for use on the Java State railways.

The Forestry Department of the Netherlands Indian Government is installing a complete mechanical plant for logging, sawing, etc., and is also laying small railways for use in the teak forests.

In addition to the widening of the Singapore river, which is being undertaken in connection with the new harbour works at Singapore, it is understood that there is a big scheme in contemplation for the reclamation of the northern foreshore of the town.

COMMERCIAL AVIATION IN DUTCH COLONIES.

The Government of Holland is alive to the possibilities of air service in the Dutch East Indies, and to that end quite a number of officers of the Dutch East Indies army are presently studying aeronautics at Vickers' factories in England. A large number of military aeroplanes have been ordered by the Dutch Government for service in the operations in their Indian and Eastern colonies, and a factory is to be established at Amsterdam by the Fokker people. In addition an aerial mail service will be established between Holland and the Dutch East Indian colonies. All the interned French aircraft in Holland have been purchased from the French.

EXHIBITION OF BRITISH GROWN TIMBER.

The exhibition of timber grown within the British Empire, which has been organised by the Department of Overseas Trade, was opened in London on 5th inst. Specimens are included from all parts of the Empire, and include an interesting series of exhibits from North Borneo, amongst them being planks of *billian* (ironwood), one of the strongest timbers known; *seriah* (cedar), a wood with a pretty grain used largely for furniture-making; *mirabau*, an excellent substitute for teak; *selangan batu*, another wood of great strength and durability; and *kapor* (camphor wood), employed in house-building, etc. Some of these timbers have been tested by the Advisory Committee of the Imperial Institute with highly satisfactory results. Boxes of samples of North Borneo timbers can also be seen.

A licence for M. Claude's process for obtaining synthetic ammonia from atmospheric nitrogen has been obtained for the United Kingdom and Colonies by the British Cumberland Coal Power and Chemicals, Ltd., while the exclusive licence for Japan and China has been secured by Susuki & Co.

The Rubber Growers' Association has decided to give cordial support to the forthcoming Rubber Exhibition and to the International Rubber Congress, which will be held in connection therewith next year in London. The Association's activities will be on the lines of its participation in the 1914 Exhibition. Sir Ernest Birch, K.C.M.G., is chairman of the R.G.A.'s special Exhibition Committee, and special sub-committees are being appointed to deal with competitions, the Plantation Rubber Section of the International Rubber Congress, etc. Sir Ernest will also act as chairman of committees for the exhibition organisation.

THE VALUE OF PARA RUBBER SEED AND ITS PRODUCTS.

On one or two occasions the characteristics and value of Para rubber seed and its products have been dealt with in these pages, notably so in the issue for July, 1918, which gave a full report of experimental crushings from particulars supplied by Messrs. Rose, Downs and Thompson, the oil mill machinery manufacturers, of Hull. Such articles have shown that Para rubber seeds contain 20 per cent. or more of oil, the air-dried kernels about 45 per cent. That in many respects the oil compares favourably with linseed oil, and should find a ready market at a price certainly not lower than two-thirds the value of the latter oil. Also that the residual decorticated cake is comparable in nutritive value and digestibility with linseed cake and decorticated cotton-seed cake, and should be readily saleable as a feeding stuff. The oil and cake may be produced on the spot at a central mill or the dried kernels shipped to the United Kingdom.

A very wide inquiry into the matter has recently been made by the Imperial Institute, and fuller and more exact information is now available, particularly as to cost of production and the possibility of establishing a regular trade in the seed and its products.

INDUSTRIAL USES FOR THE OIL.

The Para rubber tree commences to bear seed when about four years old, at first in small numbers, and when about eight years old the tree comes into full bearing, the seeds falling as the fruit ripens. The principal crop of seed is obtained in September, October and November, and a small crop about February to April. The seeds yield a drying oil similar to linseed, but with a lower iodine value. If properly dried, the seeds can be stored in gunny bags for periods up to six months without deterioration. In previous articles fairly full particulars have been given of the technical trials of the oil. It may therefore be sufficient to state here that the oil is suitable for paint and varnish manufacture, but dries more slowly than linseed oil and with a "flatter" surface, and it is more readily saponifiable. It is not completely satisfactory for linoleum manufacture so far as the tests yet made indicate. It is suitable for the manufacture of soft soap, for this purpose being about equal in value to linseed or cotton-seed oil, and it is possible that the oil may also be suitable for the manufacture of rubber substitutes. The process of "hardening" liquid oils by hydrogenation may also open a new market for rubber-seed oil for use in the manufacture of edible fats. The results of the trials clearly show that there would be no difficulty in finding a market for Para rubber-seed oil providing it was put on the market at a reasonable price and in large quantities.

The cake or meal left after the removal of the oil forms a valuable feeding stuff for livestock. When the entire seeds are treated, however, the value of the residue is reduced, owing to the large amount of fibre present. Cake from the decorticated seed is strikingly similar to linseed cake and meal in composition, and, what difference there is, is in favour of the former. It is somewhat inferior to decorticated cotton-seed meal, but much superior to undecorticated cotton-seed cake.

PREPARATION OF THE SEED.

In preparation of the seed, it is advised that the same should always be decorticated or shelled, whether the oil is prepared in rubber-growing countries or the seed exported. In the former case, decortication is desirable, as the quality of the cake is better than if the whole seed is crushed. Where it is intended to transport the latter to any distance, decortication is essential, as the shells constitute 50 per cent. of the weight of the seed, and are of little value except as fuel. Kernels for export should be thoroughly dried before being packed in bags for shipment. The oil may be removed from the kernels, either by expression or by extraction, with solvents in the usual way. The plant required for treating other seeds would, substantially, be quite suitable for treating rubber seed. Such plant might require modifications or additions, but such changes would be solely in the preliminary plant.

The question as to whether it will pay the rubber grower to exploit the seed as a by-product of the rubber industry depends on a number of factors, the chief of these being the cost of collecting the seeds. The profit would be small or practically non-existent where estates are unfavourably placed for transport of bulky products of comparatively low value, or where estates grow cover crops rendering collection difficult. Estimates of the amount of seed yielded per acre per year and of costs of collection are very variable. The earliest estimate gave 111 seeds to the pound, or 248,640 seeds to the ton, but this does not state whether the seeds were air dried or freshly gathered. The seeds contained 60 per cent. by weight of kernels, so that 414,400 seeds would require to be collected to produce a ton of kernels. At this rate, with trees yielding 400 seeds each, and planted 15 feet apart, *i.e.*, 193 to the acre, 5.4 acres of plantation would be required for the ton of kernels. The estimate referred to as given in the *Bulletin* of the Imperial Institute gave the cost of placing the kernels on the market in 1903 as follows:—

	£	s.	d.
Freight	2	2	0
Collecting seed at 4 cwt. per 1,000	2	3	6
Decorticating per ton		5	10
Packing per ton	1	15	0
	£6	6	4

ESTIMATING THE PROFITS.

Taking the value of the kernels at £11 (the price in the United Kingdom in 1903), this would give a profit of £4 13s 8d., or about 16s. per acre. But it has been pointed out that this estimate referred to seeds from untapped trees, and that the seeds from tapped trees would be smaller and lighter. It is advised that seeds be collected once in two or three weeks during the fruiting season, when children could be employed at, say, 0.9d. per thousand seeds. Systematic collection will probably prove too costly, as, with air-dried kernels, later estimates give 427,000 seeds to the ton. A fairly close estimate gives 400 seeds per tree as an average yield, 90 trees per acre, and 2,000 seeds to weigh 17 lb., giving 306 lb. of seed to the acre, or from 11⅓ to 12¼ acres to produce a ton of kernels. A further estimate shows as many as 850 good seeds per tree, and the cost of collecting and bringing seeds to the factory at as low as 0.84d. per thousand. Most of the earlier estimates are incomplete, omitting in some instances cost of decortication or cost of supervision, insurance, depreciation of plant and brokerage.

Summarising the various estimates and figures, it appears safe, according to the finding of the Imperial Institute, to assume that about 500,000 seeds must be collected to furnish 1 ton of air-dried kernels. Costs of collection in Malaya would work out at £1 11s. 8d. at 3.18 cents per 1,000 seeds, or at £2 18s. 4d. at 5 cents per 1,000. For the purpose of a conservative estimate, the higher figure is taken. Decortication may be placed at from 10s. to 15s. per ton of kernels, and packing in gunny bags 10s. Carriage from estate to rail, from rail to port, and freight from the Federated Malay States at pre-war rates total £3 15s. per ton, making the total cost of exporting the kernels amount to between £7 and £8 per ton. Adding costs for insurance and sale in the United Kingdom and depreciation of machinery, it seems unlikely that Para rubber-seed kernels can be sold in the United Kingdom at less than £9 per ton. But this is a conservative estimate.

VALUE OF THE SEED AND CAKE.

Placing the value of Para rubber-seed oil and cake at only two-thirds of the value of linseed oil and cake, which are subject to wide fluctuations, a margin of profit would be shown on the sale. During the war kernels could certainly have been sold at a fair profit, even allowing for high cost of freight. Under present-day conditions the export of the kernels would also be profitable, even putting the value of the oil at only two-thirds the value of linseed. But it is practically certain that Para rubber-seed oil will command a price much nearer linseed oil. It has done so on trial shipments in the past, when its merits were less known than they are to-day. It has been suggested that the rubber seed should be worked up on the spot in rubber-growing countries. This would be advantageous if large central oil mills were established, and a variety of seeds treated as rubber seed could only be available certain months in the year. Extra expense would of course be incurred in storing the oil for transport and shipment in drums or casks, but such expense would then be largely avoided in the countries importing the oil. By producing the oil in the country of origin, the cake produced could be utilised locally either as a feeding stuff or as a manure, so that impoverishment of soil does not take place. Up to the present no regular trade in Para rubber seed or oil has been established; as it becomes established economical methods of working will present themselves, and profits become more certain and more appreciable. A gradual reduction in the cost of ocean freight also is probable. In view of the enormous demand for oils and feeding stuffs, of the obvious necessity for the exercise of economy on rubber estates, of the increasing area under rubber and the large quantities of kernels obtainable, it is highly desirable that serious efforts should be made to organise the collection of Para rubber seed wherever it is likely to prove at all profitable, and so prevent waste of material which is undoubtedly of appreciable value.

EXHIBITS AT THE INTERNATIONAL AIRCRAFT EXHIBITION IN LONDON.

The Sixth International Aero Exhibition, being held at Olympia as this issue goes to press, is held when the aircraft industry is in a state of transition. Many have questioned the wisdom of holding an exhibition at such a time. From a commercial and trading point of view such a view may be accurate enough, and the comparatively small number of machines and engines exhibited gives point to such criticism. In other respects, however, the promoters, the Society of British Aircraft Constructors, have been well advised, and much indirect benefit will result from the exhibition. The display of exhibits is sufficiently representative to show that Great Britain is more than maintaining her position in the industry. They will do not a little to familiarise business circles and the public generally with aircraft and to give a clear idea of the advances which have been made in construction and design since 1914, when the last exhibition of the kind was held in London. The exhibition is also well calculated to increase knowledge of and confidence in aviation for commercial purposes. From these points of view the exhibition may be held not only as having been justified but as proving successful.

A TORPEDO-CARRYING SHIP AEROPLANE.

Several of the machines shown in the more important exhibits, such as those of Messrs. Vickers and the Handley-Page Co., have already been described at length in this journal. Attention may therefore be directed to those machines comparatively new or little known. Amongst such is the "Swift" torpedo-carrying ship aeroplane by the Blackburn Aeroplane and Motor Co., Ltd., of Leeds. Official permission to exhibit it has been granted on condition that certain special equipment, notably the torpedo gear, is not shown, and for an equal reason this gear cannot be described. Hence the machine exhibited may be regarded simply as a ship aeroplane of high performance and high load-carrying capacity. As a ship aeroplane, the "Swift" is fitted with airbags for flotation in the event of forced landing at sea and with wheels, automatically removable in the air, to render such landings safe. Slings for hoisting aboard ship are also fitted. To facilitate stowage on shipboard the machine folds its planes, and the folding gear is of interest not only for its sound mechanical design but also because it is the first gear to allow the folding of staggered-planes; this permits an appreciable improvement of the pilot's view and a slight increase in performance. Safety from fire has also received attention. The engine installation is cut off by a fire-proof bulkhead from the remainder of the fuselage. The main fuel tank is of the self-sealing type, petrol being thence pumped positively to a small gravity tank in the upper plane. From the standpoint of efficiency in performance the design is best judged on the figures appended which have been forwarded to us by the makers.

Span (open), 48 ft. 6 in.; span (folded), 17 ft. 6 in.; length, 35 ft. 6 in.; height, 12 ft.; engine, 450 h.p. Napier; total weight, fully loaded, 6,000 lbs.; useful load (including crew but not fuel), 1,975 lbs.; fuel capacity, 4 hours full power; mainplane area, 720 sq. ft.; full speed, 98 knots; landing speed, 43 knots; getting off speed, 40 knots; run to unstick, 40 yds. in 20 knot wind; range, 392 nautical miles; rate of climb, 850 ft. per min.; service ceiling, 15,000 ft.

MESSRS. BEARDMORE'S EXHIBITS.

The main exhibits on Messrs. William Beardmore's stand are two specimens of the firm's peace-time aircraft, the W.B.2 and the W.B.10.

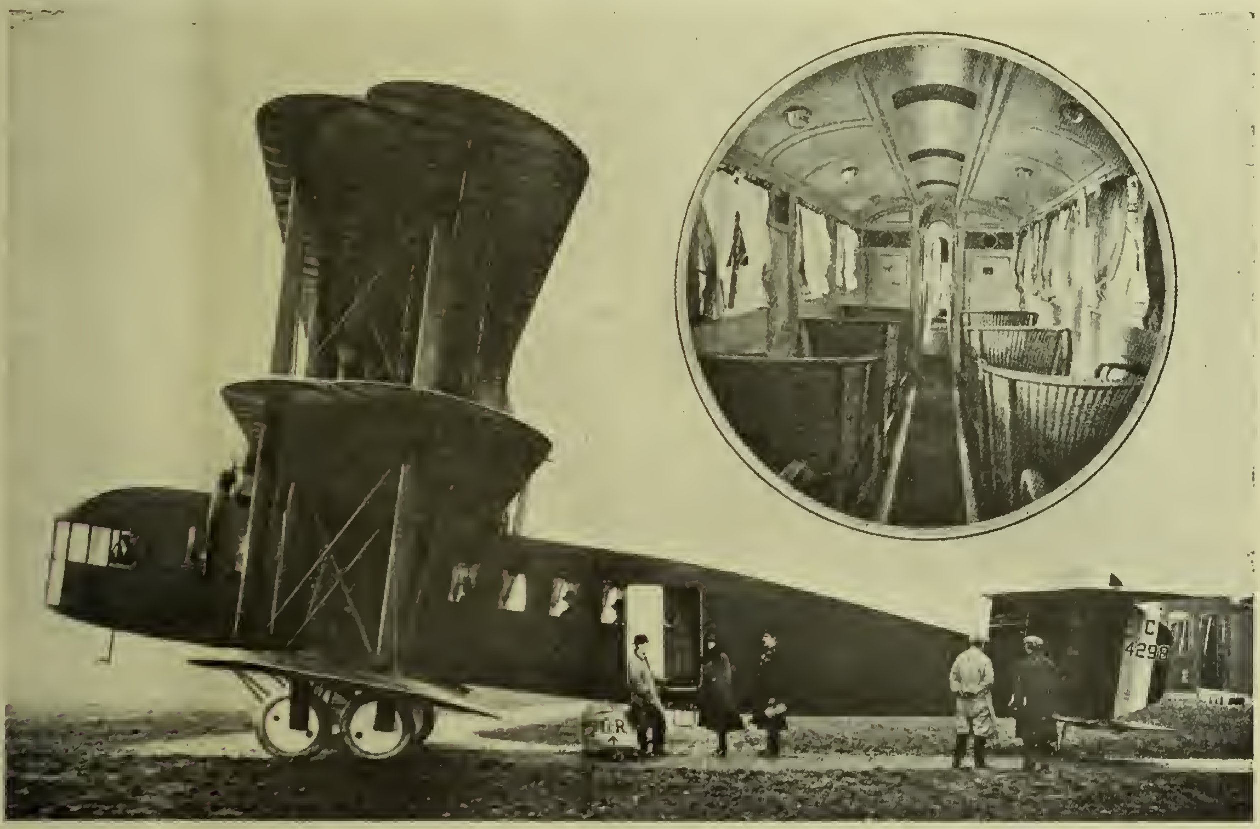
The former is a two or three seater, 27 ft. long with a span of 35 ft., fitted with a Beardmore Aero engine of 160 or 200 h.p as desired. The weight fully loaded is 2,500 lbs., of which 170-340 lbs. is available as "useful" load, i.e., the equivalent of two passengers and average luggage. The maximum speed with a 160 h.p. engine is 107 m.p.h., which is distinctly good for a commercial machine of such moderate power. The cruising range at a low altitude is over 400 miles, while petrol consumption works out at 9 miles to the gallon. From the pilot's point of view an important refinement is the counteraction of propeller torque by lateral adjustability of the rudder fin, which may be set beforehand so that in normal flight the pilot can take his feet off the rudder with safety.

The W.B.10 is interesting as being the actual machine which the firm is entering for the Air Ministry Competition, to take place this year. It has a long range—which makes for good *average* speed on long journeys of several stages—and the very low landing speed of 40 m.p.h., which contributes towards both safety and economy in the matter of aerodrome space. Though the machine shown has wings partially of wood the final entrant will be of all-metal construction, and it is interesting to note that the average loading works out at almost 25 per cent. less than that of a standard wooden-framed aeroplane. The wings fold back so that, though having a span of 46 ft. when ready for flight, the W.B.10 occupies a hangar only 20 ft. wide by 30 ft. long and 13 ft. high. The useful load is 200-500 lbs., and accommodation is provided for one passenger in front of the pilot. The maximum speed of this machine is 91 m.p.h.

On Beardmore aeroplanes the main petrol tank is in the fuselage with a small "service" tank concealed in the centre of the top plane. The fuel is raised by a wind-driven pump to the service tank, whence it flows by gravity to the carburetter, any surplus being returned by an overflow pipe to the main tank. This arrangement obviates the drawbacks of a pressure and gravity systems.

Mention should be made of the pilot's cockpit starting gear for Beardmore engines, which is fitted to all their machines and is complete and efficient in operation.

The famous 160 h.p. Beardmore Aero engine is also shown separately on this stand. It may be recalled that Sir William Beardmore re-purchased from the Disposal Board its entire stock of new Beardmore engines, confident that they were the right type for commercial flying. Already the Beardmore Aero engine has become standard on several of the chief British commercial aircraft, and has also been put to several unconventional uses with great success, such as the driving of factory plant, for which its low running costs make it an extremely economical investment.



Views of the "Bristol" Pullman Triplane.

Other Beardmore exhibits include models of R.34, the giant rigid airship of Atlantic flight fame, built in their Airship Construction Works at Inchinnan; of H.M.S. *Argus*, built in their Dalmuir Yard—the first "floating aerodrome" designed for the British Navy for carrying aeroplanes at sea; and of the firm's 10-seater 4-engined amphibian flying boat, type W.B. IX, which will be entered for the Air Ministry 1920 Competition.

Messrs. Beardmore also show a section of a passenger car such as it is proposed to use on the R.36 type of rigid airship for commercial flying.

Besides those shown at the exhibition the firm have also brought out several other useful types of aeroplanes of various sizes, including an all-metal single-seater sporting machine and touring biplane, and a large double-fuselage biplane.

Amongst the large aeroplanes constructed to provide a high speed machine capable of carrying a considerable load of passengers and cargo in addition to fuel for a lengthy flight the "Bristol" Pullman Triplane, shown at the exhibition by the Bristol Aeroplane Co., occupies a special position. This machine was referred to some time back in these pages, and the manufacturers inform us that during actual flight the machine has registered a speed of 134 m.p.h. with a cruising speed of over 100 m.p.h. with engines at little more than half throttle. In "taking off" the amount of run, after the engines were let out, was less than 180 yards, and a similar space was sufficient for the run after landing. The climbing powers of this machine are also exceptionally good. The fact that it is fitted with four engines and could maintain flying speed, if necessary, with only two of them in action also ensures reliability.

The "Bristol" 3-seater coupé touring machine shown is calculated to make an appeal to commercial users. The Siddeley Puma engine is installed, a six-cylinder vertical water-cooled engine developing 246 b.h.p. at its full normal revolutions of 1,400; it may safely be run, for short periods, up to 1,500 revs., at which the power developed is 255 b.h.p. Dual ignition, by two six-cylinder magnetos, is fitted. Two Claudel Hobson carburetters are supplied; these carburetters are made with an "altitude adjustment," which is useful for preserving a correct mixture at great heights. It is unnecessary below 10,000 ft. A nose radiator is fitted between the fore end of the engine and the air screw, fitted with venetian blind type shutters. The setting of the "fixed" tail plane is adjustable by hand lever, and a glance at the hand lever shows the tail setting.

Messrs. Thos. Firth and Sons, Ltd., of Sheffield, a firm closely associated with aviation since its earliest days, show a full range of their products which apply to the industry, including stampings, bars, sheets, test pieces, bends, etc., in carbon, nickel, chrome vanadium and nickel chrome steels, both oil and air hardening. Examples are shown of steel pressings for aero engine cylinders and of the four and six-throw crankshafts in nickel chrome steel.

The exhibits of Messrs. Rubery, Owen and Co., of Darlaston, illustrate the tendency in aeroplane construction to employ metal instead of wood for all important structural parts of aeroplanes. The firm caters for this development as they have done for the motor-car industry, producing component parts in metal, leaving the construction to the builders of the machines.

Messrs. Bruntons, of Musselburgh, Scotland, show examples of their high tension solid and stranded wires for aeroplane construction, also of streamline wires and tie rods with end fittings, wire strainers, locking plates, etc.

A similar exhibit is also made by Messrs. Bullivant and Co., Ltd., of London, and Messrs. Marconi's Wireless Telegraph Co., Ltd., showed a special display of their wireless equipment for the aircraft industry.

Although so few complete machines are on view a very wide range of accessories and equipment is assembled, which adds greatly to the interest of the exhibition, which will close on the 20th inst.

THE VAUGHAN ELECTRIC BLOCK.

On many occasions recently attention has been drawn in these pages to the large demand existing in the Far East for improved appliances to assist in the mechanical handling of goods. At nearly all larger industrial commercial centres the need for such plant is evident, and in certain instances serious delay and much complaint have arisen through the lack of modern methods and equipment.

Many types of plant have been described in this journal, the installation of which would be calculated to better the position. The particulars now given relate to the Vaughan Electric Block, manufactured by the Vaughan Crane Co., Ltd., of Openshaw, Manchester. This block constitutes a reliable, self-contained and power-driven hoist, which can be slung up anywhere, ready for instant use on the connection of a flexible supply cable. The application of electricity in this form to hoist loads for which hitherto in the Far East only hand-power blocks have been available, renders possible a most important economy of labour and a great saving of time, with consequent reduction of costs and increases of output. The varied classes of work to which it has already been applied and the numerous repeat orders which the makers state they have received, testify to its great utility, whether employed at a fixed point, as shown in Fig. 1, or suspended from an overhead travelling trolley or crane, as shown in Fig. 2. A particularly useful installation of the electric block is in connection with the wall jib crane, of which an illustration is given. Such cranes admirably meet the requirements of many situations where otherwise ordinary hand cranes only could be employed. The electric block furnishes the lifting power which is the function of a hand crane entailing the greatest amount of labour, the effort required to operate the other movements being comparatively insignificant. If required the travelling gear of the electric block can be arranged for electric operation, control being effected either by depending cords or from a driver's cage. This is usually considered necessary where the runway track is of very considerable length and where much travelling to and fro is contemplated. For electric runway hoists to deal with the heaviest class of service the makers recommend their two-motor electric trolley hoist.

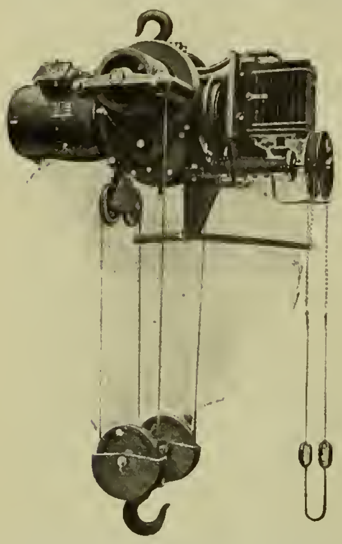


Fig. 1. Electric Block with top suspension hook for hanging on to an existing structure.

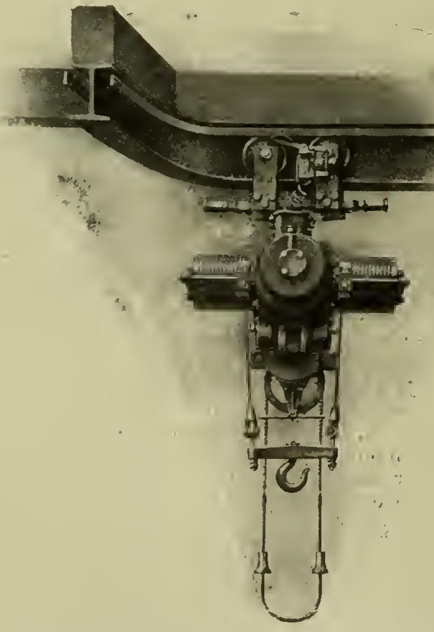


Fig. 2. Electric Block with Bogie type Trolley for passing round curves of short radius.

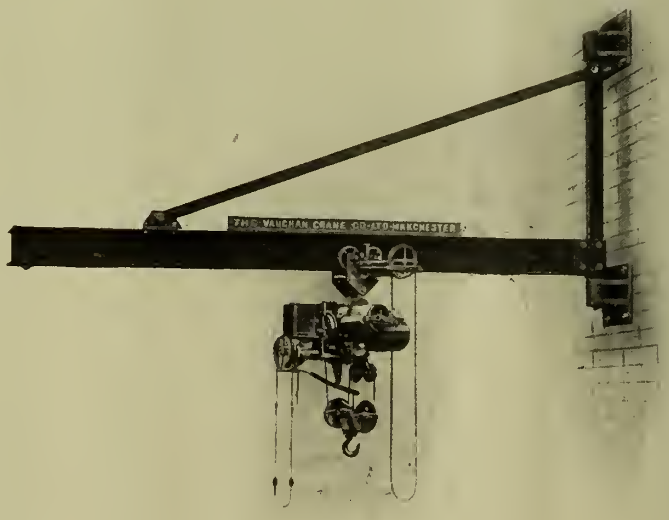


Fig. 4. Electric Block fitted to Wall Jib Crane.

The standard specification of the electric block shows that the body forms a containing case and oil bath for the worm gear. The motor is a totally enclosed, reversing, crane type, of half-hour rating, temperature rise 90 deg. Fah., and capable of dealing repeatedly with the full load. The brake is automatically applied and held on at all times, except when released by starting the motor for hoisting and lowering. The controller is of the enclosed driven type. The operating gear is fitted with automatic return to "off" position, ensuring stoppage of motor and application of brake whenever hand cords are released. The blocks are standardised in three frame sizes, each of which is supplied in two or more reefings of rope to suit different maximum loads as follows:—

	Working Load.		
	With 2 falls of rope.	With 4 falls of rope.	With 6 falls of rope.
Frame A	½ ton	1 ton	—
Frame B	1 ton	2 tons	—
Frame C	1½ tons	3 tons	4½ tons

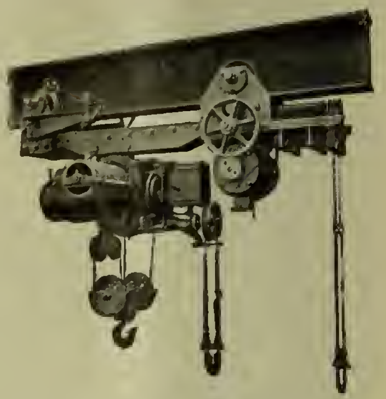


Fig. 3. Block with Electric Travelling Gear, control being effected by depending cords. In another type control is obtained from a driver's cage.

Enquiries for the electric blocks should state: — Maximum load; height from floor to point of suspension; voltage of electric supply; also phases and periodicity, if alternating current*; class of work to be done.

For electric blocks and trolleys:—Maximum load; height from floor to underside of track; voltage of electric supply; also phases and periodicity, if alternating current*; section of runway track girder; minimum radius of curves in track, if any; class of work to be done.

For overhead travelling cranes:—Maximum load; voltage of electric supply; also phases and periodicity, if alternating current*; class of work to be done; span between centres of gantry rails; height from floor to gantry rail level; end clearance between centre of gantry rail and wall at each end; headroom from top of gantry rail to underside of roof principal.

For wall jib cranes:—Maximum load; voltage of electric supply; also phases and periodicity, if alternating current*; class of work to be done; maximum effective radius; height from floor to underside of jib; character of wall or pillar to which crane is to be bolted.

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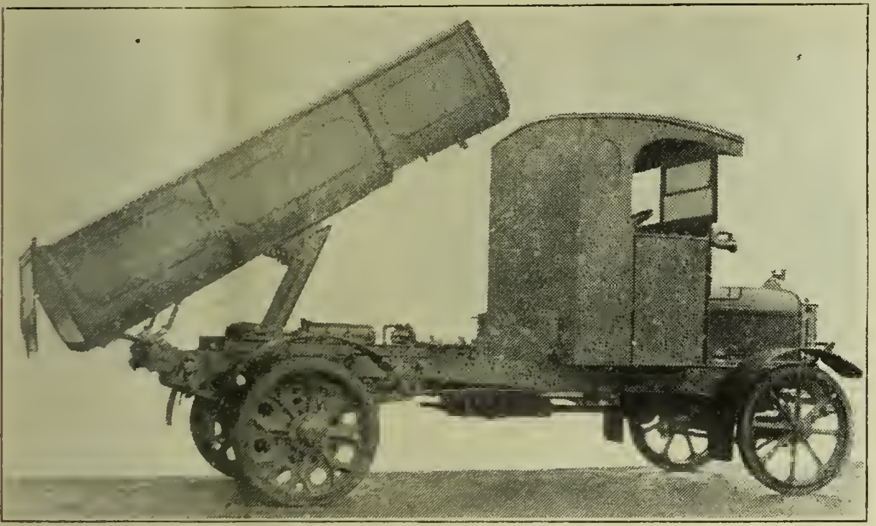
*A.C. supply 2-phase or 3-phase only.

MACHINERY EXHIBITS AT THE ROYAL AGRICULTURAL SHOW.

The seventy-ninth annual exhibition of the Royal Agricultural Society of England, just held at Darlington has been notable by the number and variety of its machinery exhibits. They probably constituted a record. Each year such exhibitions become more important to Far Eastern markets as the potential machinery requirements of these centres develop into actual demands. In certain directions, moreover, conditions in agriculture in the Far East have changed during the last few years, and the demand for plant is no longer limited to the requirements of small individual farms with their limited possible purchasing power. This fact enhances the interest and importance of the Royal Show exhibits for the Far East, and machinery which until recently would have been regarded as too complicated and unsuited in scope for the East is becoming now a sound business and economic proposition for this part of the world.

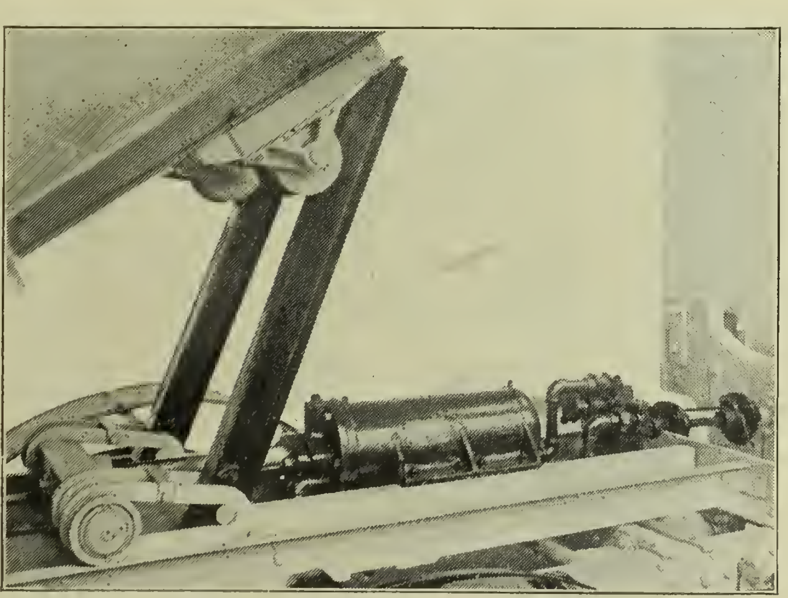


Daimler End-Tipping Lorry.

The commercial motor vehicle and means of mechanical transport generally were particularly well represented. The steam lorry and steam tractor for general haulage work were strongly in evidence. This method of transport is well holding its own, and its extended use seems assured as rubber tyres are more generally employed. Messrs. Clayton and Shuttleworth, Ltd., Lincoln, include in an exhibit of traction and portable steam engines, a 5-ton steam wagon mounted on rubber tyres and fitted with a mechanically-operated tipping body. The tipping mechanism consists of two strong screws with nuts having journals which work in brackets secured to the underside of the body. Rollers are attached to the body, which engage with inclined channels during the process of tipping. The tipping gear is operated through a clutch and side shaft from the engine of the motor.

Many fine exhibits were made by firms associated with Agricultural and General Engineers, Ltd., of London, the total area of the combined exhibits aggregating 31,500 sq. feet. Among these Messrs. Richard Garrett and Sons, Ltd., of Leiston, showed a 3½-ton rubber-tyred electric vehicle, also a 5-ton rubber-tyred steam wagon. A steam tractor was also shown by Messrs. Aveling and Porter, Ltd., of Rochester, and road locomotives by Messrs. Chas. Burrell and Sons, Ltd., of Thetford, the combined display being thus representative of modern practice in steam and electric traction. Perhaps the most interesting exhibit on this stand, from the point of view of the agriculturist, is the Blackstone Creeper Track Oil Tractor (which incidentally is entered for the Royal Agricultural Society's Silver Medal), and is designed to be convertible to road wheels if required. The engine starts instantly on paraffin, no petrol or lamps being used, is arranged for driving machinery by belt and is fitted with an adjustable governor. Three forward speeds and reverse enable the machine to be used for either road or farm work, the normal or ploughing speed being a direct drive. The specified power developed is 25 b.h.p. Messrs. Blackstone had no fewer than 16 sizes of their oil engines on view. Electric lorries for the road were also shown by Messrs. Ransomes, Sims and Jefferies, Ltd., of Ipswich, the same firm also exhibiting a compound steam tractor. Messrs. Walker Bros., Ltd., of Wigan, exhibited types of their 40 h.p. thirty-seater char-a-banc, short wheelbase petrol end-tipping lorry and 4-ton tipping wagon with engine-operated tipping gear. A 5-ton compound steam tractor was shown by Messrs. Ruston and Hornsby, Ltd., of Lincoln. Whilst most of the commercial vehicles shown were large capacity wagons, in nearly every instance the makers also build small capacity vehicles, for which there is a growing demand in the Far East. The Austin Co., of Birmingham, showed their new 30-cwt. petrol lorry; also their automatic generating set and farm tractors, which will be described in the next issue of this Journal. A 2½-ton gear-driven side-tipping wagon was exhibited by Tilling-Stevens Motors, Ltd., of Maidstone. Messrs. J. and E. Hall, Ltd., of London and Dartford, showed a 3-ton Hallford petrol lorry. Types of reconditioned lorries acquired from the Government were also on view on this stand, and on the stands of a few other exhibitors. Messrs. Hall's vehicles range from 30 cwt. to 5 tons capacity. The firm has an excellent record of reliability for its vehicles, its latest statistics in this respect relating to a 5-ton vehicle which gives the remarkable mileage of 19,477 miles ran in one year's work with a total load carried of 2,730 tons, with only three working days off during the year. The Daimler Co., Ltd., of Coventry, exhibited a motor char-à-banc fitted with giant pneumatic tyres, and end-tipping lorry with hydraulic hoisting gear, as illustrated.

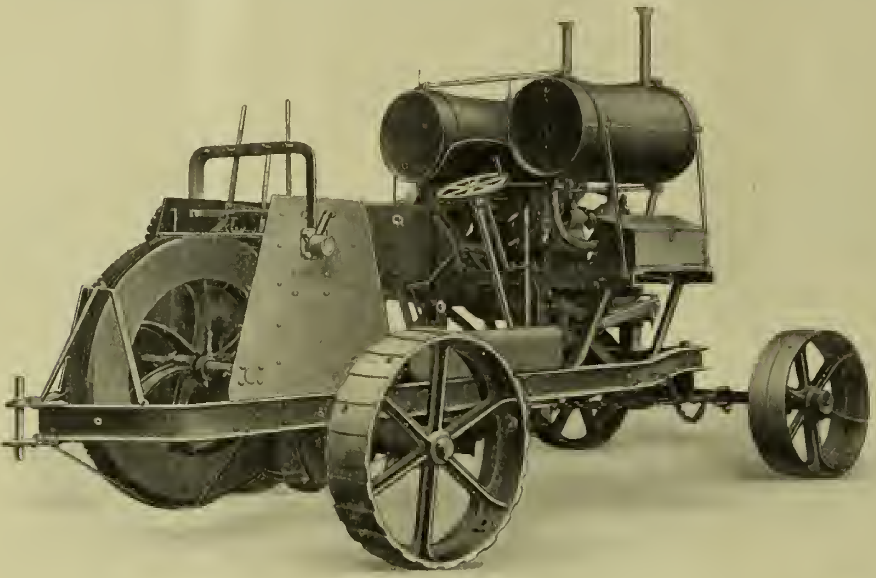
The quality of the British agricultural tractors exhibited was excellent. The self-lift tractor ploughs formed a section of interest, as the automatic lift dispenses with the extra attendant required to operate a riding plough. Messrs. J. and H. McLaren, Ltd., of Leeds, displayed for the first time their double motor windlass ploughing and cultivating tackle, illustrations of which are given. The principle of this is the same as in the steam double engine system, in which one engine is placed on each headland, and the implement is hauled backward and forward between them by means of steel ropes. The only difference is that instead of a heavy steam engine comparatively light motor windlasses, worked by petroleum or paraffin engines, are employed. Messrs. McLaren's arrangement secures one engine being stopped while the other is pulling, the idle engine on the approach of the plough or other implement to the operating engine being started by a self-starting gear worked from the tail rope going out.



Details of Hydraulic Hoisting Gear fitted to Daimler Lorry.

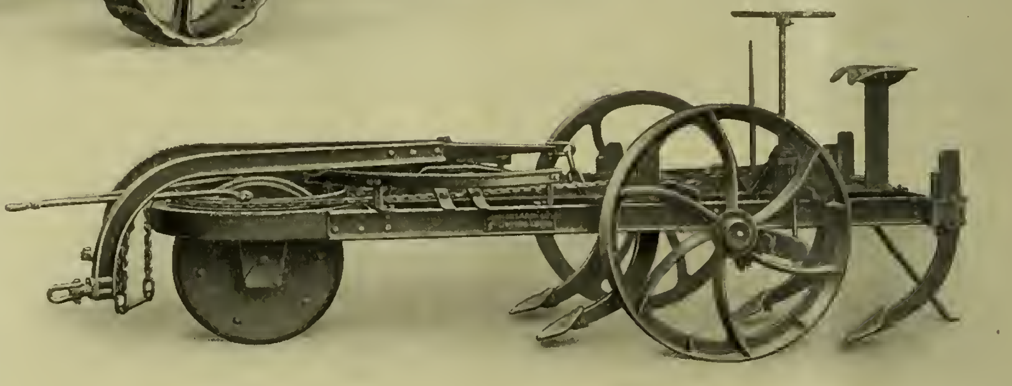
The engines are also adapted for working machinery by belt and for road travelling for transport purposes.

The Saunderson Tractor and Implement Co., Ltd., of Bedford, exhibited a 23-25 b.h.p. universal tractor with 5-6-ton trailer and two- and three-furrow ploughs for tractor work. Messrs. Leyland Motors, Ltd., made a good display of their steam and petrol vehicles, including motor fire-engine, single-deck bus, and char-a-banc. This company's list of representatives now includes agents at Rangoon and Java.

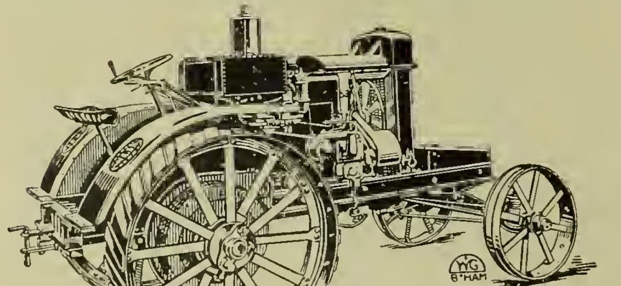


Messrs. Hadfields, Ltd., of Sheffield, showed a much wider range of exhibits than has been their previous custom. Generally speaking, in the past they have confined their attention to stone crushing machinery, but in the present case they exhibited machinery, castings and forgings which are typical of the general scope of their manufactures. The "Hecla" disc crusher, seen on the stand, occupies a foremost position as a medium for secondary reduction in obtaining a moderately coarse product. The 24 in. size is capable of accepting pieces up to 5 in. by 4 in. by $2\frac{1}{2}$ in. and reducing them at the rate of about 15 tons an hour down to $\frac{3}{4}$-in. ring material. In the process a remarkably cubical sample is produced, which forms ideal medium for "top dressing," as needed for road maintenance. Amongst a variety of appliances for collieries and mines, Messrs. Hadfields showed many patented specialities. They have long been associated with the Rowbotham self-oiling wheels and axles, which, by reason of the efficiency of the lubricating mechanism and the high grade of steel of which the wheels and axles are made, hold a wide field. Wheels fastened by Hadfield's special "Lock-fast" method on axles, and loose wheels, including some in patent "Era" manganese steel were shown. Colliery tubs, both wooden and steel, were included, with the "Sylat" prop withdrawer, the Wilde & Petrie tub controller, and a special tub greaser, all coming within the description of labour-saving machinery, rollers and pulleys, with stands and frames, together with pedestals of the bolt, open and hook designs. Locomotive centres, wagon centres, horn blocks, ramps, axle boxes, etc., form another branch wherein the reputation of the firm's special steel castings stands very high, a remark applying with equal truth to bridge castings, dredger tumblers, as well as to such items as gearing, etc., for agricultural machinery.

For all parts of machines that are subjected to excessive wear and tear, Messrs. Hadfields still claim pride of place for their patent "Era" manganese steel, every care being taken to ensure the material keeping pace with progressive scientific research. Their stand included many articles in this steel, such as jaw faces, toggles, cheek plates for jawbreakers, shells for crushing rolls, dredger bucket pins, bushes and links, barrow wheel as used for the charging of furnaces, mandrels for tube drawing, navvy digger teeth, etc., etc. Tool steel, drill steel and automobile parts made of the firm's special steels, are included, as well as shovels, forks, picks and general contractors' tools.



Illustrating Messrs. J. and H. McLaren's Double Motor Windlass Ploughing and Cultivating Tackle, mentioned on the preceding page.



Saunderson 23-25 b.h.p. Post-War Model "Universal" Tractor. Designed to work on paraffin. Two-cylinder engine with enclosed governors, half compression for ease in starting. Three speeds forward and one reverse.

Messrs. E. R. & F. Turner, of Ipswich, in their exhibit of flour-milling machinery showed their free swinging and self-balancing plansifter; and Messrs. Howard, of Bedford, had some forty-five examples of their ploughs, cultivators, and other products on view. Both the last mentioned firms are associated with Agricultural and General Engineers, Ltd.

Mr. William Boyd, general manager of Swan, Hunter and Wigham Richardson's shipyard at Wallsend, has been appointed managing-director of Workman, Clark and Co., shipbuilders and engineers, Belfast.

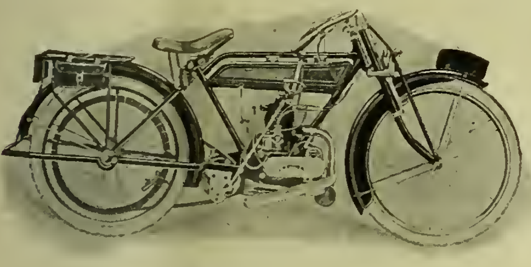
The death is announced of Mr. E. H. Smith. He had been associated with N. Hingley and Sons, Ltd., Netherton Ironworks, Dudley, for 48 years, and became a director of the firm some years ago.

Acting on medical advice, Mr. Dudley Docker has resigned his seat on the boards of Vickers, Ltd., the Metropolitan Carriage, Wagon, and Finance Co., and the Patent Shaft and Axletree Co.

Mr. R. Eddison has resigned both his chairmanship of the board of directors and his seat on the board of Davy Bros., Ltd., of Sheffield, because of advancing years and ill-health. Mr. Eddison had been a director of the company for 24 years and chairman for 15 years. Sir William H. Ellis has been elected chairman of the company. Mr. A. Peech, of the firm of Steel, Peech & Tozer, Ltd., has been elected a director.

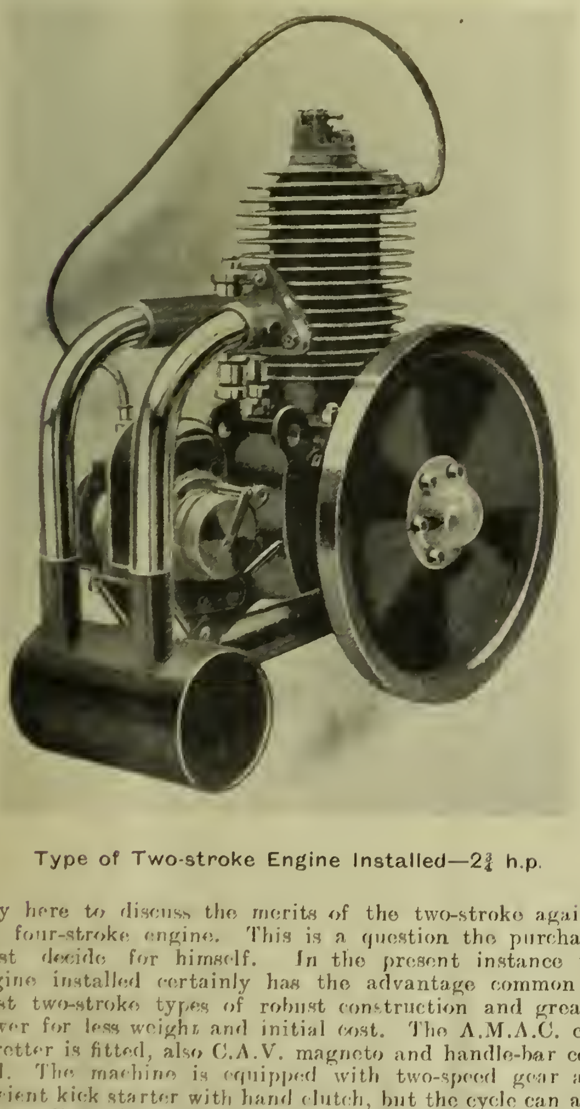
A NEW TWO-STROKE MOTOR CYCLE

Messrs. Sanders, Rehders & Co., Ltd., of London and Manchester, inform us that they have placed on the market the "Sarco-Reliance" two-stroke motor cycle, illustrations of which are here given. The price at which this bicycle is supplied for export should enable it to be retailed in the Far East at a figure which will compare very favourably indeed with the cost of high-grade machines of British manufacture; and in view of the popularity which motor cycling has obtained in the Far East a wide market should be available for the new machine. In Shanghai, indeed, the latest mode of conveyance is a motor-cycle with a ricsha attached to it. The driver sits in the usual place on the cycle with the ricsha coolie just behind him, and a passenger—generally a lady—sits in the ricsha.



The "Sarco-Reliance" Motor Cycle.

The neat appearance the cycle makes is indicated in the smaller illustration accompanying this notice, and first-class equipment is supplied with the machine. An "Endurance" two-stroke engine, single-cylinder unit, is installed, bore 70 m/m, stroke 70 m/m, equalling 269 C.C., and giving 2¾ horse-power. During recent years the two-stroke engine has made substantial headway, and in selecting this type, Messrs. Sanders, Rehders & Co. have probably correctly judged the trend of future development. It is not necessary here to discuss the merits of the two-stroke against the four-stroke engine. This is a question the purchaser must decide for himself. In the present instance the engine installed certainly has the advantage common to most two-stroke types of robust construction and greater power for less weight and initial cost. The A.M.A.C. carburetter is fitted, also C.A.V. magneto and handle-bar control. The machine is equipped with two-speed gear and efficient kick starter with hand clutch, but the cycle can also be supplied without kick starter or with single-speed gear at reduced prices. Transmission is by belt and chain-cum-belt. Sight drip-feed lubrication is supplied, and the tank has two compartments, two caps and petrol tap, fitted with lubricator. The choice is given of first-class makes of tyres, saddle, etc. The machine contains no novelties. It is sturdily constructed on conventional lines, and it is claimed for the machine that it will compare favourably on the open-road and in hill-climbing abilities with other more expensive motor cycles.



Type of Two-stroke Engine Installed—2¾ h.p.

POWER ALCOHOL.

A year ago the report of the official Inter-Departmental Committee in London was published in this Journal on the production and utilisation of alcohol for power and traction purposes. Since that time much consideration has been given the matter, and although, unfortunately, no definite action has been taken on any very general scale, information on the subject is more general and far reaching. Industry is also nearer the threatened shortage of petrol than a year ago, and this is hastening progress. It is now unquestionable that the demand for the fuel exceeds the supply, not only in Great Britain, where the price compares favourably with other countries, but throughout the world generally. A very large proportion of the Far East is rich in the vegetable produce essential for the production of power alcohol. It is believed that its possibilities in this direction could be rapidly developed, and that a valuable opportunity is offered the Far East by the industrial requirements of other countries. If such development is delayed too long the Far East may find itself forestalled as a supplier of raw materials to make alcohol. Already in Natal, South Africa, always one of the most enterprising of British colonies, a mixture has been patented under the name of "Natalite," containing 60 per cent. of alcohol and 39 per cent. of ether, to render the spirit more volatile, and small quantities of arsenious acid and ammonia gas. Ether itself is, of course, easily manufactured from alcohol. Certain materials comprising mainly vegetable matter, now considered waste products, yet known to contain alcohol, such as the pulp remaining after decortication for fibre of sisal and other plants, offer an excellent field for research and experiment. A variety of starchy and vegetable materials which thrive in the Far East are available for alcohol production, and their cultivation could be profitably extended.

In consequence of the fact that alcohol is less volatile than petrol it has generally been found necessary, as previously stated, to add to the alcohol a certain proportion of more volatile material in order to enable it to be used in engines constructed to work on petrol. A mixture of 20 gallons of 95 per cent. alcohol with 5 gallons of benzol, to which 8 ozs. of naphthalene have been added, is stated to work quite satisfactorily in petrol engines, with no alteration except to the carburetter.

Alcohol, termed in Great Britain denatured alcohol, that is, alcohol rendered undrinkable in a prescribed manner and used free of Excise Tax, can, however, quite well be used by itself in internal-combustion engines of suitable construction. The correct construction of an engine intended to burn alcohol differs in certain details from that of one adapted to run on petrol, but the differences are not great, and the necessary alterations can be made without much difficulty to an engine constructed for petrol. In employing denatured alcohol alone, without the addition of a more volatile material, it is necessary to use some other means, such as warming the carburettor with a spirit lamp or otherwise, to overcome the difficulty in starting "from cold." This is not an insuperable objection with stationary engines, but would be more serious in the case of automobiles, and for the latter purpose it is likely that a mixture of alcohol with a more volatile material will be found more generally acceptable.

There are other purposes for which alcohol could be employed more extensively than at present, if it were available in sufficient quantities at a cheap rate. Thus it can be used for lighting, either after being "enriched" by the addition of some liquid burning with a luminous flame, or by vaporising it, and burning the vapour in specially constructed burners with incandescent mantles. Heating and cooking appliances have also been made to burn alcohol vapour in place of coal gas.

Official restrictions and almost prohibitive duties on imported alcohol hinder progress at present in Great Britain, but the need for cheap and ample supplies of power alcohol is becoming too pressing for such restraints to stand much longer in the way. What the Far East has to remember is that it is necessary so to proceed and so to hasten development that when these restrictions are amended or abandoned ample supplies of raw material are available.

THE "LUMBANG" OIL (CANDLENUT OIL) INDUSTRY IN THE PHILIPPINES

According to Aguilar (*Philippine Journ. Sci.*, as quoted in the *Bulletin* of Imperial Institute in London), two kinds of "lumbang" nuts are known in the Philippine Islands—"lumbang bato," *Aleurites moluccana*, and "lumbang banucalag," *Aleurites trisperma*. The former is more widely distributed, and is the source of commercial lumbang oil. The other variety has the reputation of causing skin eruptions, and the merchants are averse to handling it. The manufacture of lumbang oil has been carried on in a crude way, chiefly by Chinese, for a long period, but the oil industry is now undergoing change; improved methods are being adopted, and some of the large local coconut oil factories are paying attention to lumbang oil. In the past it was thought that the available supplies of lumbang nuts were insufficient to induce merchants to invest capital in the industry, later it appeared that considerable quantities of nuts could be obtained, and in 1910 it was stated that sufficient seed could be obtained from Laguna, Tayabas and Batangas to render the installation of machinery near San Pablo, Laguna, a profitable undertaking. Information now available indicates that the supplies of nuts from Mindanao, especially in the Davao Gulf district, where large quantities of nuts are now left to waste, could be increased largely.

Any accurate estimate of the crop of lumbang nuts is difficult, but as long ago as 1911 one manufacturer claimed that it would be possible to supply a modern oil mill, working over 230 metric tons of kernels a month; and it is estimated that owing to the efforts of the Bureau of Forestry to encourage planting, about half a million trees a year are being planted, so that an increasing supply of nuts is assured. The fruits mature in June and July, and are best collected during July and August.

Lumbang oil is at present used in the Philippine Islands for caulking vessels, for soft-soap manufacture and for paints, while the demand for the oil by paint manufacturers in the United States is much in excess of present supplies.

The removal of the kernels from the hard woody shells is somewhat difficult, and in some cases the whole nuts are crushed and the oil expressed. In the latter process the yield of oil is lower, and the value of the residual cake is much less than when the kernels only are worked, while the output of oil and cake from whole nuts would be less and the labour involved greater than with kernels worked in the same factory. No mention is made of the possibility of extracting the oil from the whole nuts by the solvent process, though this process would enable all the oil to be extracted and yield a cake free from oil and therefore preferable for use as a fertiliser.

Various methods, all more or less troublesome, of removing the hard nut-shells (comprising about 66 per cent. of the nuts) are employed. By sun-drying of the nuts, followed by cracking, most of the kernels are obtained unbroken and are of good quality, but the process is tedious. In Laguna, Tayabas and Batangas the nuts are placed in tanks of boiling water and left for five or six hours; by this means the kernel is loosened in the shell, and after cooling the nuts are cracked. In some localities the Chinese cover the nuts with straw, which is then burned and the nuts immediately sprinkled with cold water, when, it is claimed, the nuts burst. In the two last-mentioned cases the kernels are of brown colour, owing to long heating, and yield brown oil, so that the kernels are inferior to those obtained from sun-dried nuts. A method worked out by the Bureau of Science consists in heating the nuts in an oven to 95 deg. C. for three or four hours, after which they are thrown into cold water and left overnight: it is stated that the shells burst, and can be separated without difficulty from the kernels, which yield oil of good quality. The method employed for removing the shell is of great importance, as the oils from the brown, heated kernels are of dark colour, and contain large amounts of free fatty acids, compared with oils from fresh kernels.

The "lumbang bato" nuts can be stored for a year or more in a cool dry place without appreciable alteration in the amount or quality of the oil, but prolonged storage of the kernels is undesirable, as the oil becomes more acid and the kernels are liable to attack by insects.

The "lumbang banucalag" kernels rapidly deteriorate even when stored in the form of whole nuts; they have a much thinner shell than the "bato" nuts, and yield an oil closely related in character to Chinese wood oil.

It is recommended that efforts should be made to produce commercial supplies of "banucalag" oil. The difficulties of working this oil owing to deterioration of kernels during storage could be obviated by working up the "banucalag" nuts early in the season, and storing the "bato" nuts, which do not deteriorate, for future use.

It is of interest to note that *Aleurites moluccana*, the "candlenut" tree, is widely distributed in the tropics and occurs in, or has been introduced into, a number of British possessions, from which samples of candlenuts, kernels and of oil have been received at the Imperial Institute from time to time and submitted to examination, although no appreciable quantities of kernels or of oil have appeared on the markets in the United Kingdom.

In view of the demand which has arisen for the oil in the United States it seems desirable to recommend the collection of nuts in all British Colonies where they can be obtained in any quantity so that efforts can be made to introduce this oil to the notice of British manufacturers. It would obviously be undesirable to ship the whole nuts, which consist of only about 34 per cent. of kernel; the nuts should be dried and cracked, and the kernels only shipped. It appears unlikely that the kernels will deteriorate if properly dried and shipped without undue delay. The value of the kernels and of the oil in the United Kingdom is somewhat uncertain, but there seems no doubt, in view of the very high price of linseed oil at the present time, viz., about £126 per ton, that kernels or oil of good quality would meet with a ready sale if regular shipments of 100 tons or more at a time could be obtained.

COAL PRODUCTION IN JAPAN.

Exports of coal and coke from Japan have rather noticeably decreased since 1916. This, coupled with the increase in imports and the increase in production, is indicative of the industrial expansion in Japan, which has given rise to a large demand and caused the present high price of coal.

According to an estimate of the mining bureau of the Department of Agriculture and Commerce at Tokyo, based mainly on coal veins over 2 feet thick, and generally lying not more than 2,000 feet below drainage level, the available coal deposits of Japan amount to about 822,000,000 metric tons of 2,204 pounds. In addition it is judged that approximately 2,940,000,000 metric tons, which lie at greater depths, can be mined if highly efficient methods are used. It is also surmised that the concealed and undetermined deposits of coal may possibly amount to 5,030,000,000 metric tons

It is estimated that Kyushu has 75 per cent of the available coal resources in Japan. The remainder is divided as follows: Hokkaido, 10 per cent; Honshu (main island), Shikkoku, Taiwan, Chosen, and Karafuto, 15 per cent. With the exception of about 60,000,000 metric tons of anthracite in Kyushu, and the Iwaki-Hitachi and Nagato districts, all the coal in Japan is bituminous.

The number of metric tons of coal mined in Japan in 1919 is given as 30,832,325, an increase on 1918. The rate of increase has not since been maintained. Imports of coal and coke into Japan increased in 1919, as compared with previous years, the imports coming chiefly from China and Kwantung Province. Exports from Japan materially decreased in quantity in the same period.

Japan's consumption of coal for shipping, factory use, railways, and salt production in 1916 was 18,579, 126 metric tons, while in 1919 it was approximately 19,000,000 tons. In 1913 the consumption for these purposes was 14,924,437 metric tons, while in 1911 it was only 12,070,903 metric tons, against a production that year of 17,632,710 metric tons.

All the important Japanese mining companies use dressing machines. In 1916, first lump coal brought 10 yen a long ton; in 1918 this had increased to 22 yen and by March of this year the price had grown to 37 yen, due mainly to unreasonably high freight charges. Recent high prices had stimulated enterprise in coal-mining, but such activity will speedily subside as lower quotations obtain. Any material amount of labour unrest is not anticipated in the industry, as better treatment and higher wages have been given the miners. Efficiency generally is higher than in 1919, and this is likely to increase as modern equipment is more generally utilised.

PROTECTION FOR RUBBER TAPPING CUTS.

An invention has been patented by Mr. S. J. Halley, of London, which comprises a drain or gutter composed of flexible or deformable material and adapted completely to surround the tree and thus to direct all the rain water collected in the branches away from the cut. Desirably, the device is of V or U section, and is arranged at an angle to the horizontal. The device may be secured to the tree as by tacking with non-ferrous fasteners, a bead being preferably interposed between the fasteners and the drain or gutter.

MODERN ENGINEERING PRACTICE.

MODERN METAL MELTING.

Valuable information on modern practice in the use of electric furnaces for melting metals was submitted recently to the Birmingham Metallurgical Society by Mr. A. J. G. Smout, A.I.M.M. The type of furnace which most closely approximates to the ideal is the electric furnace. There are types which melt brass quite satisfactorily, and it is the furnace of the future. The question is often asked whether electricity is really applicable to the melting of non-ferrous metals and alloys; much depends on local conditions. What was a brilliant commercial success in the U.S.A. with cheap energy, or in Norway, where it was even cheaper, might be a complete economic failure where current was costly, in which case there seemed little prospect for the electric melting of non-ferrous alloys becoming a practical proposition, except perhaps to a limited extent on special work where the cost of melting was quite secondary to the production of a really first-class alloy. Even with steel, the electric furnace is in Great Britain chiefly engaged in the manufacture of the more expensive alloys, and many furnaces had to be closed during the past twelve to eighteen months on account of their inability to compete on economic grounds with other furnaces. Obviously the most economical method of melting metal by electricity is to pass the current through it, as is done in the induction furnace, but while that method is eminently suitable for steel it has many disadvantages when applied to brass. Copper and its alloys require the greatest care in melting to avoid local over-heating and loss by oxidisation and volatilisation. They usually have to conform to a rigid specification, and must be quite uniform in composition with the varying constituents thoroughly alloyed. Those essentials rule out several types of furnace which give excellent results in steel melting. Among the advantages to be derived from melting non-ferrous metals in electric furnaces are high thermal efficiency, accurate control of temperature, no flue losses, high quality of castings, sulphurous gases being entirely excluded, and neither noise, fumes, nor excessive radiated heat.

ADVANTAGES OF ELECTRICALLY DRIVEN TURBINE PUMPS

While turbine-pumps may be driven by any time of prime mover, the electric motor is now given first place as regards efficiency and convenience. Evidence on this finding of modern engineering practice was given at the recent meeting of the Institution of Water Engineers at Birmingham. The installation costs of the electrically driven pump, including foundations, are low, and the space occupied small. The pump and motor require very little attention, as the bearings are automatically lubricated with oil-rings. Low installation costs permit the sets to be conveniently distributed. They are easily started up, and can also be operated from a distance or automatically stopped and started, either by varying levels in the reservoir or by varying pressures between pre-determined limits. The alternating-current motor is preferable to the direct-current machine owing to the absence of a commutator, and most of the installations at work are driver by A.C. motors. If a heavy current rush on starting is permissible, it is advisable to instal squirrel-cage motors, as the turbine-pump, owing to its low starting torque, could easily be started up by this type of motor. Economy in working is on the side of the electric pump. Instances were quoted where, with electricity at 0.75d. per unit, the cost of electric pumping was 0.5d., as compared with 0.426d., the cost of steam pumping, for the same output. In another case costs worked out at 1.18d. per 100,000 foot-gallons for steam, as against 0.957d. for electrically driven pumps. In a third instance quoted, where a Diesel engine and dynamo were installed supplying power to drive turbine-pumps built by Sulzer and the Rees Roturbo Co., at two separate stations connected by cable the costs, including all transmission losses and "shut-downs" due to interruption in working consequent on erection of additional plant, came to 0.657d. per 1,000 gallons, 100 ft. lift.

CARE OF THE FUSIBLE PLUG.

The efficiency and simplicity of the fusible plug are such that in small plants where skilled attention is sometimes lacking its importance is often overlooked, and it is not given the treatment called for. Fusible plugs should be taken out at least once every three months and thoroughly cleaned. If allowed to remain any length of time a coating of deposit may accumulate around the plug on the inside of the boiler, and this may prevent the steam emerging if the lead of the plug melts. Moreover, by removing the plug at regular intervals, little difficulty will be found in getting it out with a spanner. Where the plug is neglected it often becomes impossible to remove it, and it has to be cut or drilled out, a process entailing much time and trouble. When the plug is removed for cleaning, the scale should be chipped off and the threads of both crown plate and plug cleaned, and graphite or black lead rubbed on the threads before replacing. If not entirely removed the plug should be occasionally loosened by giving it a turn back and then tightening up again. The plugs can be easily formed in a mould when it is necessary to renew the lead and pure lead only should be used in their manufacture. In many cases the wise precaution is taken of removing the plug every three months, cleaning and running fresh lead into it. Should trouble occur through plugs blowing out without apparent cause the brass plug should be removed if it is ascertained that the trouble is not due to any obstruction or want of water. The above hints summarise correspondence which has appeared in *Motor Traction*, which calls attention to important but often little considered details in the management of small boilers.

AN IMPROVED COMPOSITE BELT.

An improved type of composite belting is being introduced which will, it is claimed, combine the advantages of balata and leather belting without their disadvantages. The composite material is composed of leather and rubber. The waste leather which is used in the process is shredded, not disintegrated, so that the fibres remain unimpaired. It is then treated by a special method to enable it to withstand the heat of vulcanisation, and is incorporated with indiarubber as the binding agent. The composite matter is corrugated and placed between two sheets of a textile fabric impregnated with rubber solution and correspondingly corrugated. These three layers, which interlock, are then pressed together. The new belt is completely protected against moisture, as each fibre of the leather is surrounded with rubber. Its flexibility and compressed property obviate tendencies to stretch or break, and give greater gripping power. All the fibres are in one direction —along the corrugations—so that the risk of breaking is reduced to a minimum. The belt is not affected by ordinary heat generated by a pulley in running. In this connection tests were made in driving a disintegrating machine. In this particular drive the pulleys got so heated that when a balata belt was used the resin melted, whilst a leather belt cracked with the heat, and only did short service. A test belt for this particular drive was made by the new process, and is running satisfactorily after two years' service. The belt is the patent of Mr. Robert Russell, managing director of Messrs. Russell's Ltd., Manchester.

EXTENSOMETER FOR WIRE TESTING.

According to the Research Laboratory of the American Westinghouse Electric and Manufacturing Co., an extensometer for testing wire and thin sections has been developed by this firm. It consists of a metal block with two flexible side pieces attached, the free ends of these carrying rollers. The wire to be tested is clamped at the block and passes between the rollers. Extensions of the wire between the blocks and rollers due to loading the wire results in rotation of the rollers, which are held in contact with the wire by the flexibility of the side pieces. Light from a small straight filament galvanometer lamp passes through a collimating lens to a mirror in the axis of one roller. From there it is reflected to a similarly placed mirror on the other roller, and reflected from there to a white scale divided into millimetres. An extension of about 0.0001 in. causes a movement of the spot of light to a distance of 1 millimetre on the scale. The position of the spot of light can be read to 1/5 mm. The instrument has been in constant use for several months with satisfactory results. Specimens have been tested having sectional areas ranging from one-tenth down to twenty millionths of a square inch, with satisfactory results.

CRACKING OF H.T. INSULATORS.

Cracking in large built-up H.T. insulators is nearly always caused by the cement used in cementing the different parts together. Most ordinary cements become very hard with time, and having a different thermal expansion to the porcelain used, they cause the latter to become mechanically stressed, and so cause cracking and breaking when the insulators are heated up. A number of firms use an elastic compound between the cement and the porcelain, but here also the same trouble is experienced with the lapse of time, as the elastic medium also oxidises and hardens. The remedy suggested as most satisfactory is to add to the cement materials having a lower thermal expansion than the cement, so that the thermal expansion of the compound is reduced to approximately the same value as that of the porcelain. A compound of this type, termed "Telco" cement, has been patented, and has given very satisfactory results in use. It has also a higher mechanical strength than pure cement.

ELECTRIC RAILWAY CONTACT SYSTEMS.*

SUPREMACY OF THE OVERHEAD SYSTEM AS INSTALLED IN GREAT BRITAIN.

There are two distinct types of contact systems used on electric railways from which the current to feed the trains is collected. The older, and the one most generally in use, being the conductor or live rail, which is only in use with direct current, at pressures varying from 500 to 1,300 volts, though it is proposed to increase the pressure with this system up to 1,500 volts.

Where pressures of 3,000 volts, d.c., or 6,000 to 16,000 volts, a.c., or 3,000 to 5,000 volts 3-phase are concerned, the questions of safety and of insulation have made it imperative to use overhead conductors. There is one case in Great Britain where an overhead conductor is used with a pressure of 1,500 volts, d.c. The overhead conductor has been used in this case to clear the tracks and yards of live conductor rails.

So far only three countries have decided to standardise any one system for general railway electrification. These countries are Sweden, Switzerland, and Germany, which have definitely adopted the single-phase 16,000-volt 16 2-3-period system with an overhead conductor. France is investigating the matter, and it appears probable that she will adopt the 3,000-volt d.c. overhead system, thus standardising the voltage as well as the system.

Italy has so far not arrived at any definite conclusion, although the majority of her railways so far electrified are on the 3-phase, 16-period, 3,000-volt system. The United States has no definite standard, although the Pennsylvania Railroad appears to have decided on the single-phase system for all future electrifications.

Dealing with overhead construction for railways in a country where traffics are very intense, and the hours of service long, the overhead construction must present factors of security and safety at least equal to those obtaining on the permanent way, and it must be constructed in such a way as to enable any maintenance and supervision to be carried out in the very limited periods of time available for such purposes.

An overhead conductor can only be utilised where the currents to be collected from it are relatively small, as experience has shown that heavy currents are not only difficult to collect, but also very greatly increase the cost of maintenace.

The overhead construction and the collector arrangements on the coaches or locomotives must be such as to make the risk of a collector coming off the contact wire no greater than the risk existing to-day of the wheels of a bogie leaving the track.

In 1907, when the first overhead lines for main-line purposes were being laid out in Germany, in the United States, and in Great Britain (Brighton Railway), various principles of construction were adopted in order to fulfil the requirements mentioned above, and it is extremely satisfactory to be able to state that whilst considerable alterations have had to be carried out both in the United States and in Germany, the principles adopted in connection with the overhead construction on the Brighton Railway were such that the overhead construction in operation to-day is practically identical with that originally designed.

On the Brighton Railway the principles adopted in 1907 were :—

That the conductor wire should be as flexible as possible, and that all hard spots should be avoided.

That double insulation was essential, and that the mechanical as well as the electrical factor of safety of the insulators and overhead construction must be very considerable.

That all insulators should be placed in positions where they would be least subjected to the direct effects of the hot gases given off from the steam locomotives.

That, with the exception of complicated yards and cross-overs, the up and down lines should be sectionalised so as to be able to be cut out independently, whilst the complicated cross-over roads and yards were designed in such a way as to be sufficiently short to be coasted over.

That insulators should be only utilised under compression, and that elastic substances should always be placed between the insulator and its solid support, as well as between it and the mechanical construction which it supported.

Provision was also made when designing the insulators that there might be no possibility of moisture or water collecting and freezing, thereby fracturing the insulator.

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* Notes from an address by Sir Philip Dawson to the Institution of Electrical Engineers and discussion thereon.

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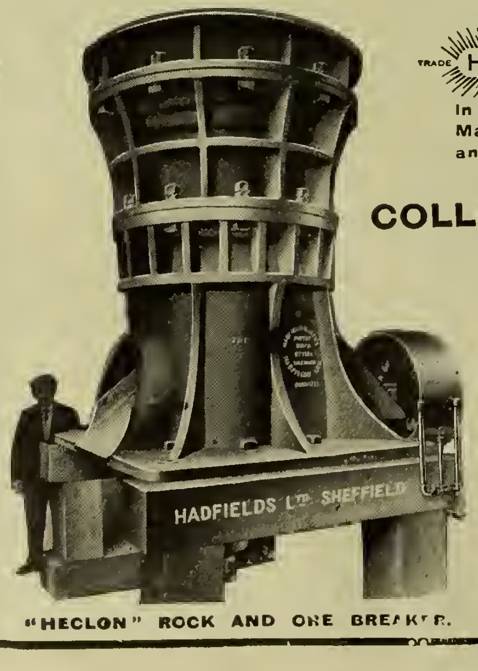

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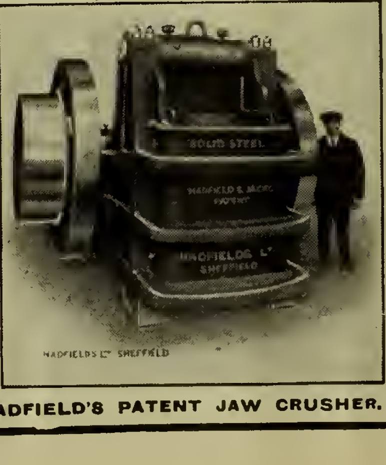

HADFIELD'S PATENT JAW CRUSHER.

The lowest live conductor is 13 ft. 9 in. above rail level, *i.e.*, 3 in. above our loading gauge.

This 3-in. clearance has worked quite satisfactorily, though a minimum of 4 in. is worked to when possible It is considered that 4 in. will be quite satisfactory for 11,000 volts.

Four inches is considered to be the minimum vertical point-to-point electrical air clearance which should be allowed for voltages from 6,000 to 11,000; therefore, a minimum of 4 in. vertically and 3 in. horizontally is provided from any part of the live bow to a structure at any height after the proper allowance for rolling stock has been made. The rolling allowance in the case of the Brighton Railway is 5 in. on either side when the centre of the bow is at 16 ft. above rail level, which is the normal height of the trolley wire.

In this case it is also considered that the minimum point-to-point electrical air clearance from any live part of the overhead line equipment to the structure should not be less than 4 in. vertically and 3 in. horizontally for voltages from 6,000 to 11,000.

Working on the principles given above, we can get a flexible overhead line construction within a minimum of 10 in. from the loading gauge to the structure, *i.e.*, within 14 ft. 4 in. above rail level, which 10-in. space is utilised as follows:—4 in.—air clearance between loading gauge and underside of trolley wire; 2 in.—depth of flexible line construction; 4 in.—air clearance between top point of live construction and structure.

In practice it has been found that there are a few isolated cases where the clearances required for a live conductor are not available, and where the cost of alterations necessary to procure these would be excessive, and would not be justified by the results gained. On the whole of the running lines so far electrified, equivalent to 70 miles of single track, there are only four instances where sufficient clearances for a live conductor do not exist. Three of these occur at the bridges where, owing to the lack of clearance, it has been found necessary to install earthed conductors.

Many patented devices of proved utility had been installed on this system, which is held to be unsurpassed for efficiency anywhere in the world. It had been shown that when the corrosive influence of smoke from steam locomotives operating over an electrified line could be eliminated the cost of maintaining an overhead system would compare favourably with that for a 3-rail system. If the system was not subjected to steam corrosion, the cost of maintenance would be very small indeed.

TRADE NOTES.

An arrangement has been entered into by which Guest, Keen and Nettlefolds, Ltd., have acquired the business of Bayliss, Jones and Bayliss, of Wolverhampton. The acquisition adds to the resources of Guest, Keen and Nettlefolds, which has been gradually expanding since the formation of the company in 1900. Early in this year controlling interests were acquired in John Lysaght through an exchange of shares, and jointly with John Lysaght in the Meiros Collieries, which company owns practically all the issued Ordinary shares of the South Rhondda Colliery Company. The authorised capital is now £15,000,000. Bayliss, Jones and Bayliss is a well-known Wolverhampton firm. The company was registered in June, 1901, to acquire the business of ironmasters, engineers, etc., of the same name. The authorised capital is now £250,000 in shares of £1, £200,000 being Five per Cent. Cumulative Preference and £50,000 Ordinary.

Sir W. G. Armstrong, Whitworth and Co. offer for subscription £2,000,000 Six and a Half per Cent. Second Mortgage Debenture stock at 95 per cent., redeemable in twenty-five years. Subject to £2,500,000 Four per Cent. Debenture stock, this new issue ranks for security in priority to about £10,000,000 of share capital. Although the accounts have not been published since 1915, the directors are of opinion the profits for the four years since that date have averaged not less than £1,000,000 per annum. The chairman of the company has addressed a letter to the shareholders which, among other things, indicates that the present rate of turnover is about three or four times that of pre-war days.

The accounts of Crompton and Co., Ltd., the electrical engineers, of London and Chelmsford, show that the net profit for the year ended March, 1920, after providing for depreciation, interest on debentures, directors' fees, etc., and a reserve estimated to be sufficient to cover excess profits duty for the year, is £52,878, plus £17,409 brought forward. There is put to general reserve fund £15,000, to depreciation of investments £9,000, dividend of 10 per

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  - Cresylic
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  - Sulphuric
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- Alum Sulphate
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- Asphalt
- Basic Slag
- Benzol
- Bricks (Fireclay and Silica)
- Caustic Potash
- Caustic Soda
- Coal Tar
- Copper, Acetate
- Copper, Iodide
- Copper, Nitrate
- Copper, Sulphate
- Cresols
- Dry Felt Fibre
- Glucose
- Glycerine
- Hair (Manufactured)
- Lubricating Greases
- Molasses
- Motor Spirit
- Naphthas
- Naphthalenes
- Oils: Anthracene
  - Blastfurnace Creosote
  - Coal Tar Creosote
  - Essential
  - Fuel
  - Fusel
  - Fish
  - Gas
  - Green
  - Lubricating
  - Paraffin
  - Petroleum
- Oils: Whale
- Paints
- Pitches
- Red Lead
- Resins
- Soaps (hard and soft)
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cent. for the year on the preference shares £13,688, dividend of 10 per cent. per annum on the ordinary shares £14,422, leaving to be carried forward £18,177.

The Rubber Growers' Association, of London, is offering substantial awards for ideas and suggestions for extending the present uses or for encouraging new uses for rubber. Suggestions must be practical and likely to increase the demand for the raw material. Ideas will be welcomed for the application in new directions of existing processes, methods of manufactures, or for improvements or new processes which will facilitate or cheapen the production of rubber goods. The closing date for receiving suggestions is December 31 next.

General Electric Co., Ltd. (London).—The report shows that for the year ended March, 1920, the net profit was £630,143. In the previous year it was £480,828. The dividend on the ordinary shares is 10 per cent., free of tax. £85,329 is put to depreciation; £150,000 to reserve; £40,000 to Superannuation Trust Fund; and £251,423 is carried forward subject to the duty of excess profits.

Tredegar Iron and Coal Co., Ltd., in their accounts, show:—Profit, £208,930; brought forward, £13,000; divisible profit, £221,930; depreciation, £10,000; dividend on A and B shares, 15 per cent., free of tax, £185,475; carry forward, £26,455. This company is establishing a separate concern to build up an export trade in its products.

The report of Swan, Hunter and Wigham Richardson, Ltd., shows:—Net profit, £447,747; brought forward, £45,403; further ordinary dividend, 7 per cent., making 10 per cent. for year, free of tax; reserve account, £150,000; reserve for equalisation of dividends, £50,000; benefit of employees, £10,000; carried forward, £52,801.

Waygood-Otis, Ltd., of London, have paid a dividend of 7½ per cent. on the ordinary shares for the year ended March, 1920. Carry forward, £14,446. The net profit for the year was £48,760, against £27,252 in the previous year. Stock and work in progress was approximately £90,000 more than a year ago.

Petters, Ltd., the oil engine manufacturers, of Yeovil, pay ordinary share dividend at the rate of 10 per cent. per annum, free of tax, for the year ended March, 1920. To reserve, £8,000; written off expenses of issue of additional capital, £5,645; carried forward, £20,219.

The Rees Roturbo Manufacturing Co., Ltd., of Wolverhampton, will pay a dividend of 15 per cent. on preference for the years 1912, 1913 and 1914; £3,500 for maintenance of buildings, plant, etc.; £1,683 to bad debts reserve; £2,853 forward.

Negotiations have been completed, it is stated, for an amalgamation of interests between Marple and Gillott, Ltd., Sheffield; Thomas Butlin and Co., Ltd., Wellingborough; and the Northampton Direct Casting Co.

Edgar Allen and Co., Ltd., of Sheffield, announce:—Ordinary dividend, 10 per cent. (2s. per share), free of tax, making 15 per cent. for year; general reserve, £20,000, making £69,000; carried forward, £47,568.

The accounts of Mirlees, Bickerton & Day, Ltd., the Diesel engine manufacturers, of Stockport, show profit, £41,842; dividend for year, 12½ per cent., free of tax; reserve, £5,000; carried forward, £5,720.

The balance sheet of the Coventry Chain Company, Ltd., shows:—Balance at credit of profit and loss account, £31,123; available, £17,274; write off cost of issue of new capital, £6,588; carry forward, £10,685.

W. & T. Avery, Ltd., the weighing machinists, of Birmingham, declare a further dividend of 10 per cent., making 15 per cent. for the year ended March. To reserve, £20,000; carry forward, £23,003.

Bell's United Asbestos Co., Ltd., of London, announce a balance dividend of 1s. 6d. per share on ordinary shares and a bonus of 1s. per share, making 17½ per cent. for year; carried forward, £26,046.

Edgar Allen & Co., Ltd., of Sheffield, declare a final dividend of 2s. per share on the ordinary, making 3s. for the year, free of tax. To reserve, £20,000. Carried forward, £47,568.

Sir W. G. Armstrong, Whitworth & Co., Ltd., have made arrangements to undertake the manufacture of water turbines to the designs of Jensen & Dahl, of Christiania.

John Lysaght, Ltd., the constructional engineers, of Bristol, declare a final dividend of 10 per cent., making 20 per cent., subject to tax, for year.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of London, announce an interim dividend of 2½ per cent., free of tax, on ordinary shares.

British Mannesmann Tube Co., Ltd., of London, have paid an interim dividend of 4 per cent., less tax.

Messrs. Hadfields, Ltd., of Sheffield, announce an interim dividend of 6d. per share, free of tax.

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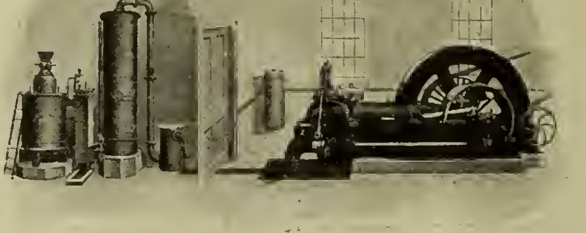

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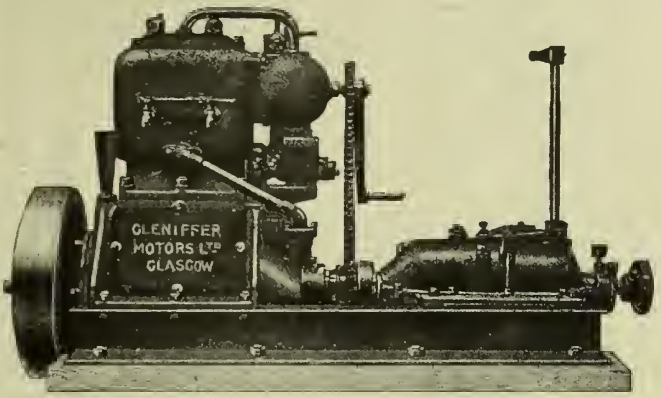

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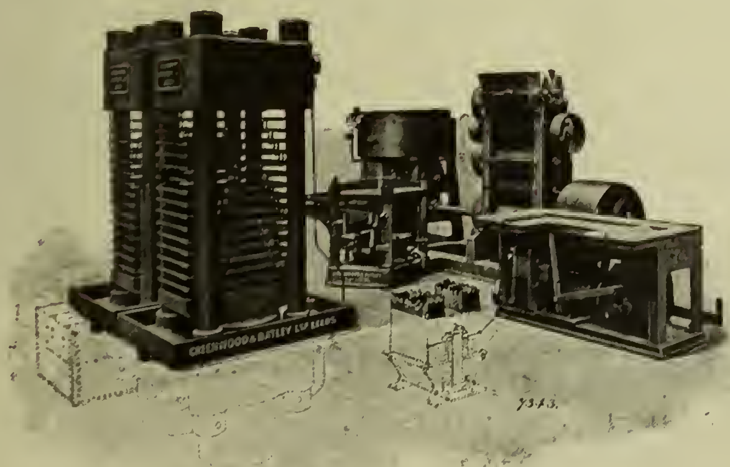

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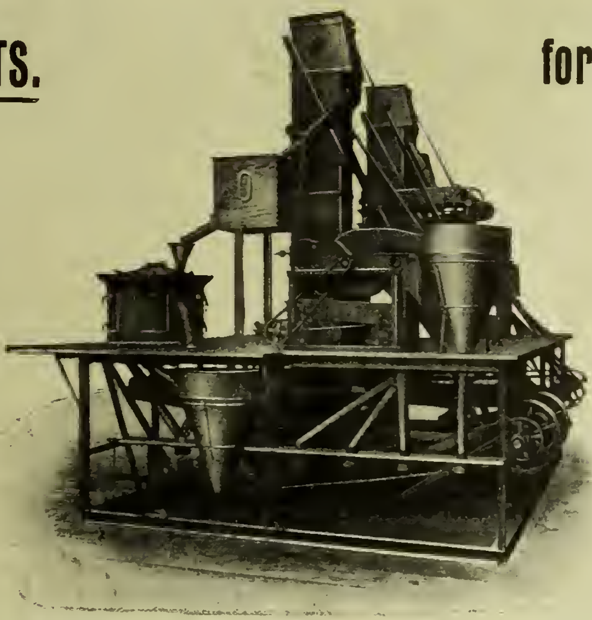

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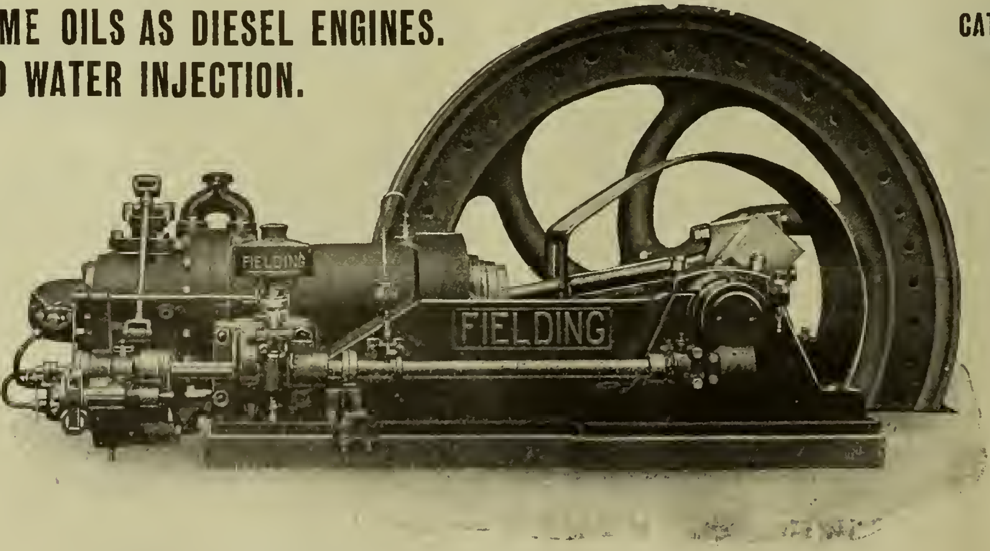

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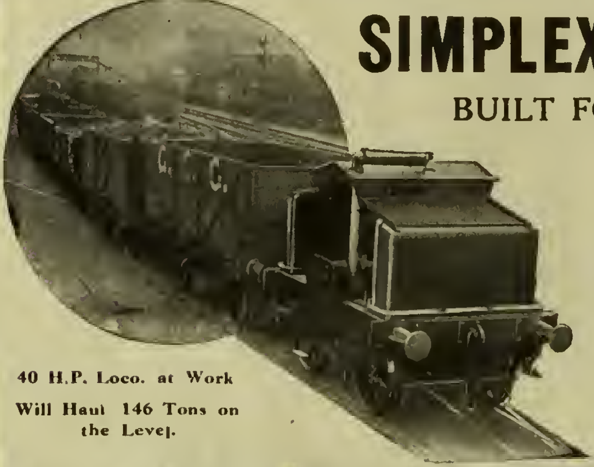

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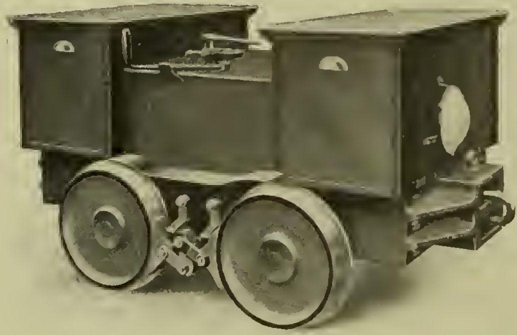

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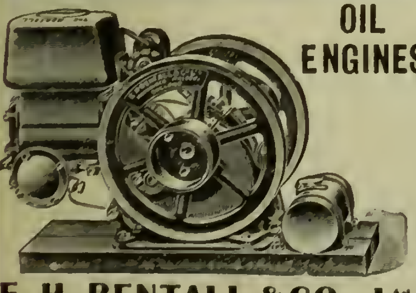

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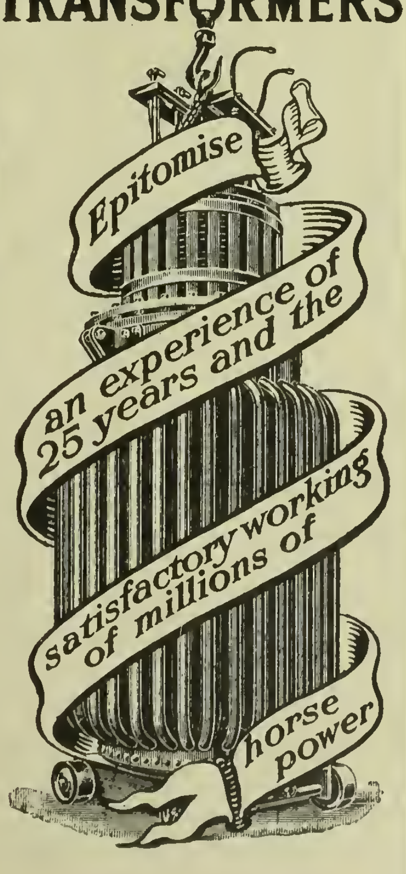

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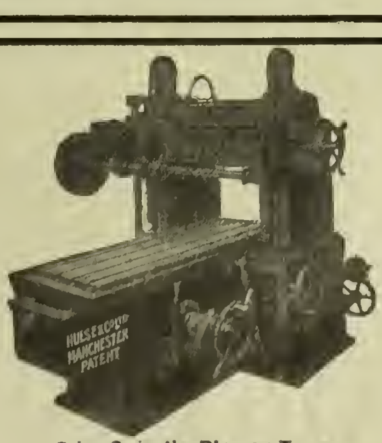

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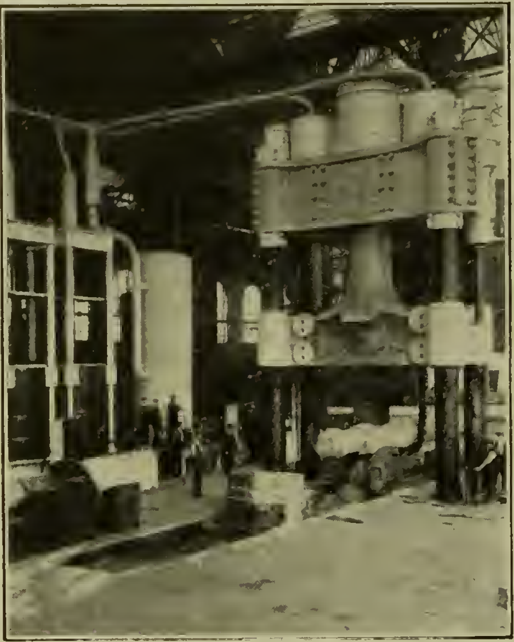
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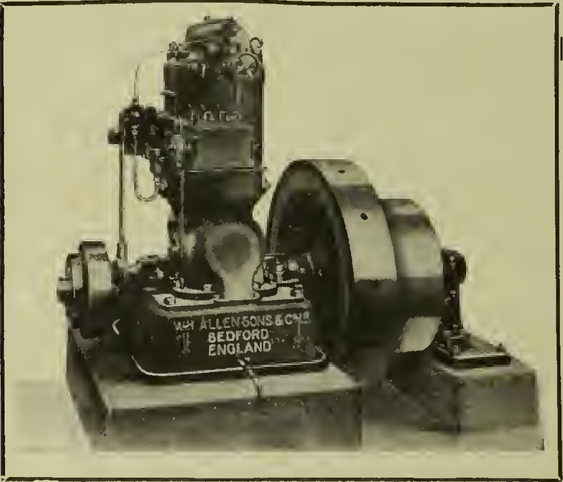

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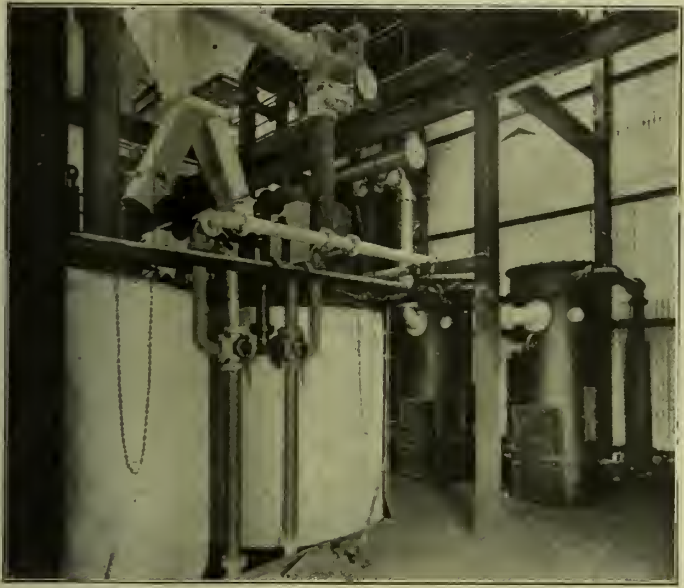

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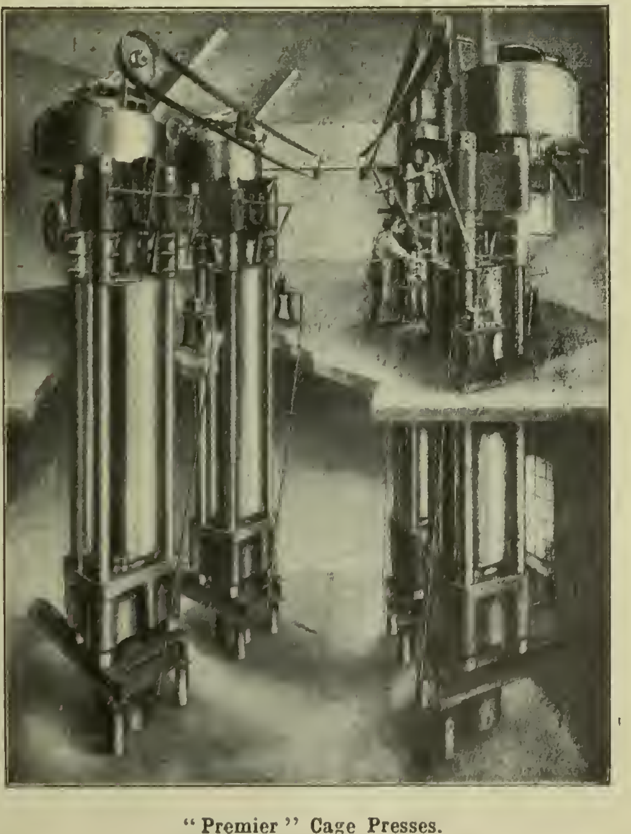

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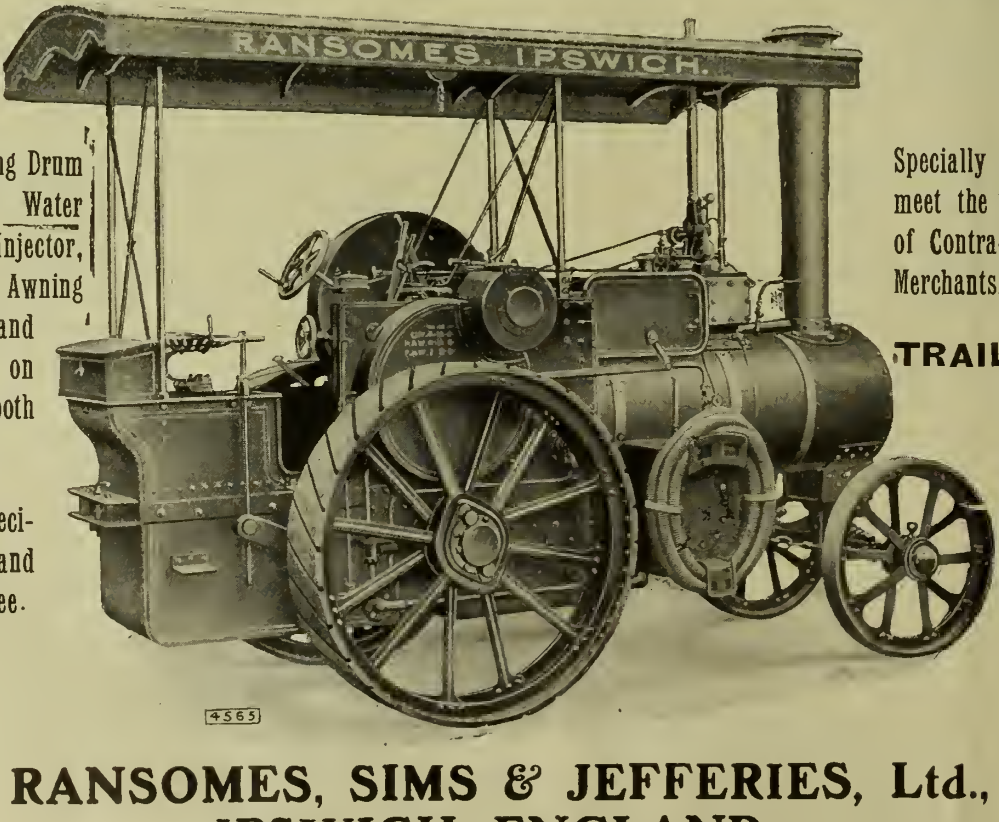

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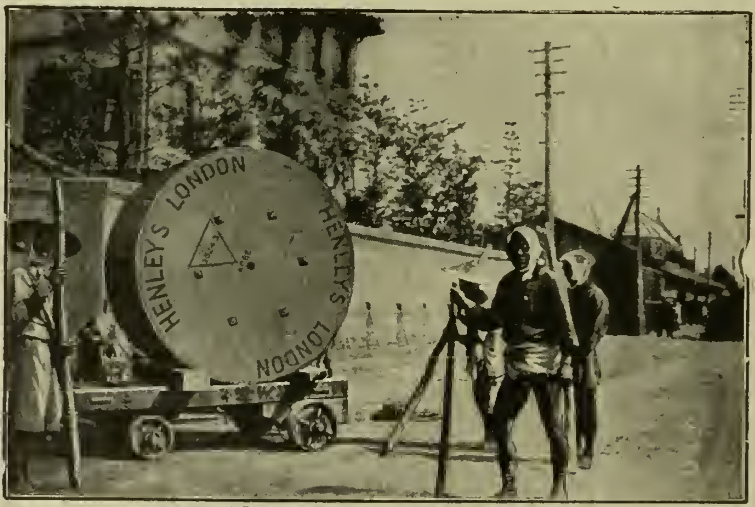

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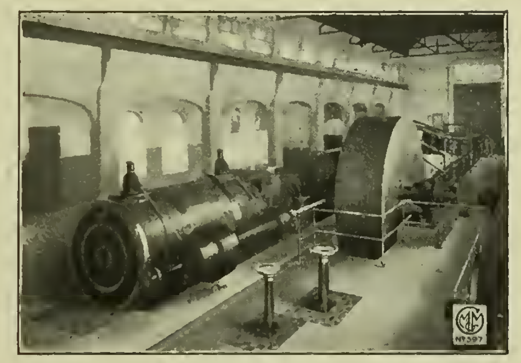

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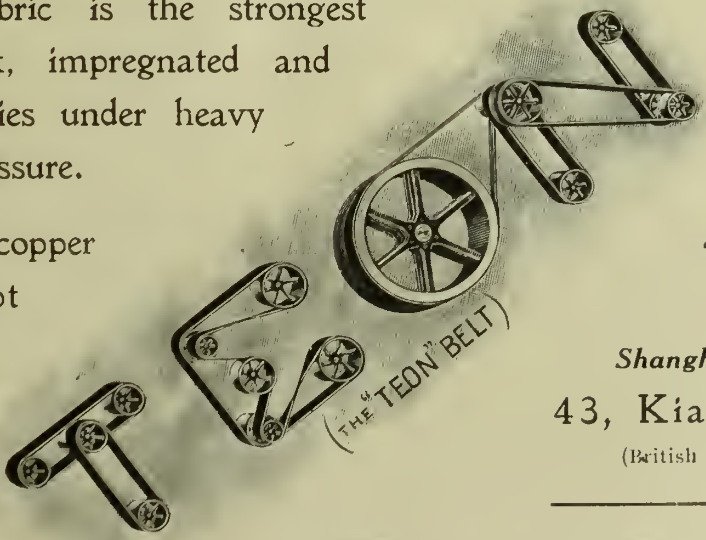

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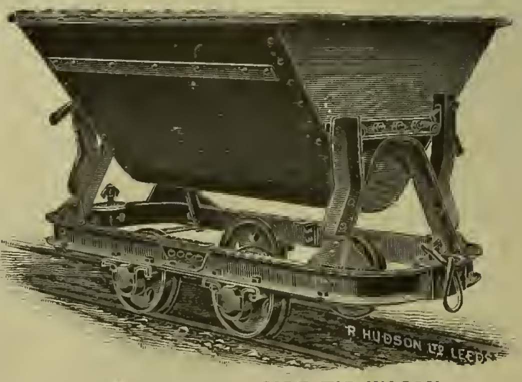

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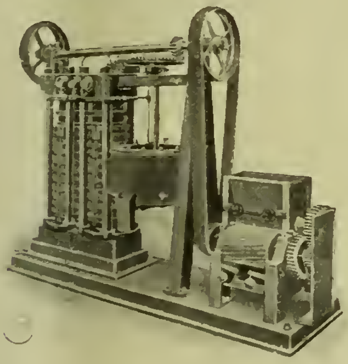

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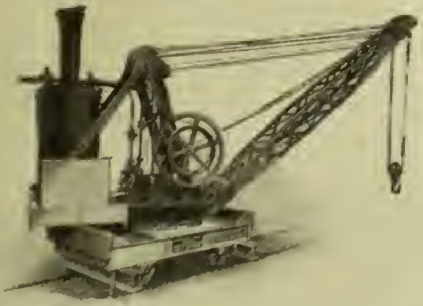

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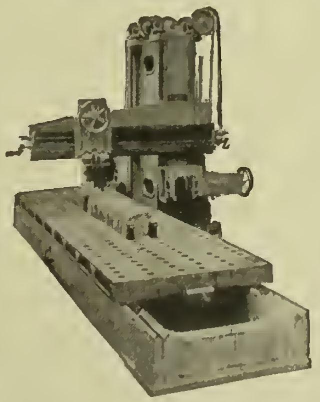

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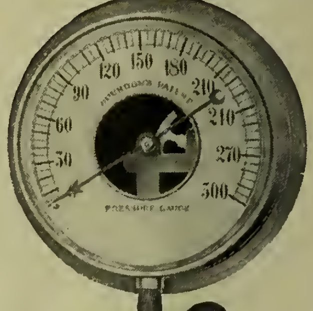

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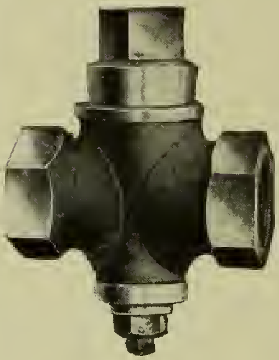

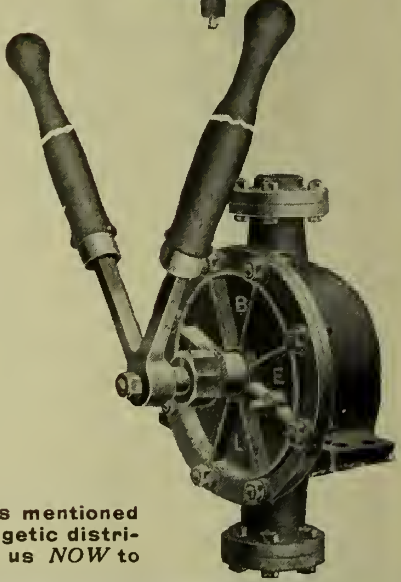

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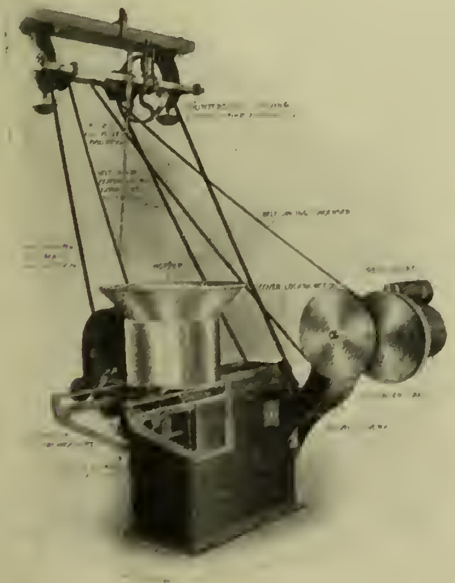
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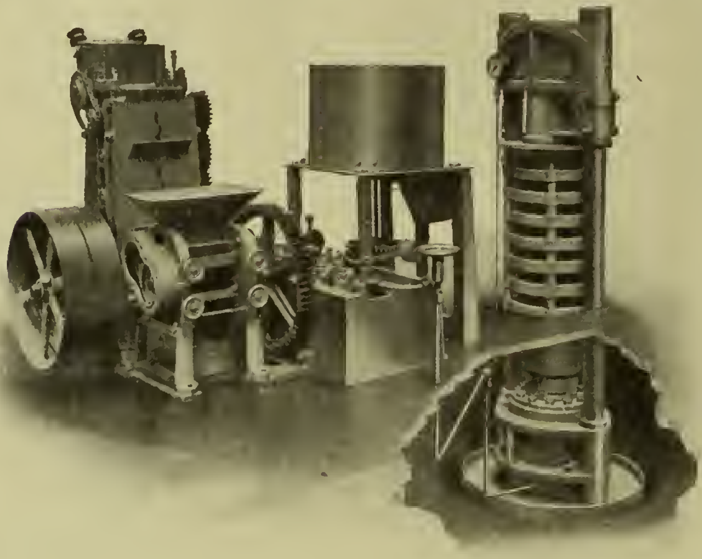

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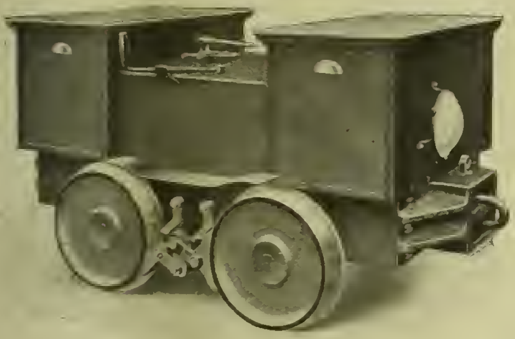

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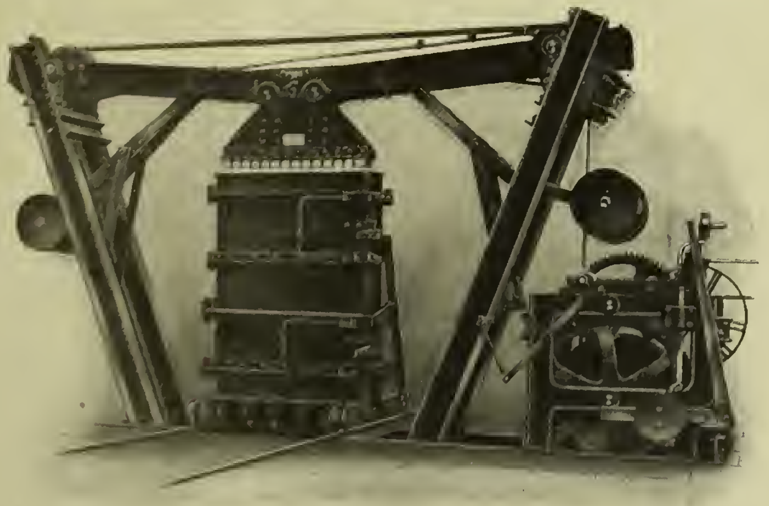

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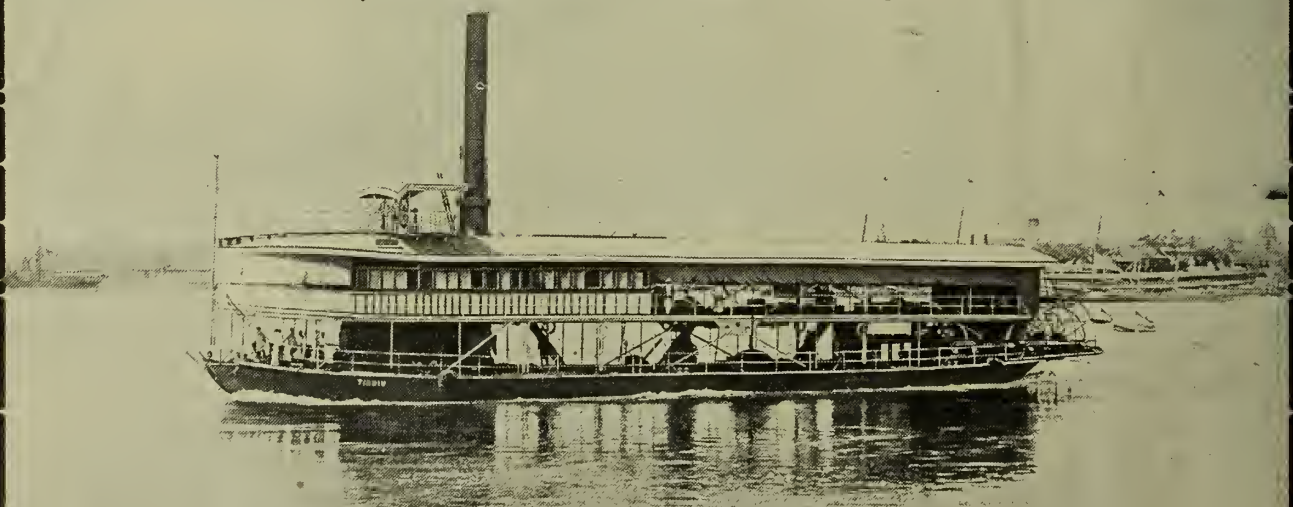

The above represents a shallow draught Sternwheel Steamer, length 130 ft., beam 31 ft., draught 3 ft. when carrying 110 tons.

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which touch upon Anglo-Oriental engineering interests are invited, and the Editor will consider articles from contributors on these subjects.

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NOTES AND COMMENTS.

JAPANESE COMPETITION

The extent and nature of Japanese competition in both India and Australia have been referred to recently by authorities, whose statements will carry particular weight alike through their present official position and their close acquaintance in the past with Far East conditions. In the case of India the authority is Mr. Thomas M. Ainscough, O.B.E., Senior Trade Commissioner for that country. Mr. Ainscough's work in China as special Commissioner for the Board of Trade will be well remembered by those concerned with China trade. Mr. Ainscough took up his official duties in India at the beginning of 1918, and is now on a visit to Great Britain. He draws attention to the great opportunity given Japan to push her manufactures in India by Great Britain's absorption in the war. He believes that high-water mark was touched in 1918-1919, since when there is evidence of a tendency for trade to resume its former channels, aided by the general preference shown for British business methods and products. Mr. Ainscough pays a tribute to Japanese industry. The Japanese scattered throughout India for commercial purposes are greater workers, and have few interests outside their business. The manner in which Japan has developed her shipping, financing, and distributing organisations, and has advertised her wares, has largely contributed to her success in India. The testimony as to Japanese competition in Australia comes from H.M. Senior Trade Commissioner for that territory, Mr. S. W. B. McGregor, who also did good work for British interests in China before taking up his present appointment. In Australia Japan has made great endeavours to obtain a share of the trade. Japan's share in Australia's imports increased from quite unimportant figures in 1915-16, and from only 4.6 per cent. in 1916-17, to 11.1 in 1918-19, and her trade centred largely in textiles, fancy goods, earthenware, cement, china and glass, wood and manufactures of wood, unmanufactured vegetable products, oils, fats, and waxes. The competition from Japan which we are told exists in Australia and India, we can see for ourselves in China, where it is likely to be of a particularly far-reaching and permanent nature. Neither report makes definite reference to engineering manufactures, but machinery and equipment are clearly covered by the comments, and in this direction Great Britain is well able to meet all likely competition.

REPRESENTATION IN JAPAN.

The Board of Trade recently published in its *Journal* comments concerning the representation of British manufacturing interests in Japan. This testimony indicates that for general merchandise it would be hard to improve on the existing agency system, under which British interests are represented in Japan by local firms, British for the most part. Where machinery is handled under the agency, representation is advisable at Tokyo and Osaka. The need is emphasised of combining in the same representative technical and commercial ability; also the advisability of his being attached to some established house, British or Japanese. Nothing is said about remuneration, although the wisdom of a liberal allowance for expenses is shown. But the average British manufacturer will realise ere this that where an agency has to be actively pushed the system of selling machinery on a commission basis is dead. We think the *Journal* unnecessarily vague in stating that the system of diverse interests combining their representation is "being tried." This system is past its experimental stage, and, given economical management, is satisfactory, although the field for large combinations is a strictly limited one. The necessity for periodical visits to the more important Far Eastern markets is pointed out, also the advisability of carrying stock. The lack of accommodation for carrying and displaying stock is very noticeable in Japan, and in remedying this omission a good deal of valuable business might be steered into British channels. In the meantime, those suitably placed for handling British interests in Japan will find in Great Britain no lack of firms requiring representation whose manufactures are suited to the Japanese market.

SAFEGUARDING AMERICA'S MERCANTILE MARINE

The Jones Shipping Act, which recently passed the United States Senate, is coming in for a good deal of criticism in shipping and commercial circles in the Far East. As a consequence, its operation in part has been suspended until January next year, and further concessions are likely to follow. The Bill has the worthy object of assisting to build up business for America's greatly augmented Mercantile Marine. In the process, however, it is causing upheaval in other than United States steamship lines. Americans look to find in the Bill all the authority necessary to protect their shipping industries, and to secure the American people their position on the high seas. Under the Act, British and Canadian shipping may be impelled to use Canadian instead of American ports if they are connected with transport trade between foreign ports from which trade American vessels are excluded. Vessels other than American may be prohibited from carrying freight originating in United States possessions, which, of course, include the Philippines, and preferential rates are to be granted to American freight if it is carried in American bottoms. Many lines have already moved their Pacific termini to Vancouver in place of Seattle, Tacoma, or San Francisco. Amongst such lines are the Trans-Oceanic Co., the American subsidiary of the Japanese Ocean Transport Co., the Blue Funnel Line, and possibly the Nippon Yusen Kaisha. Japanese and Chinese will hardly desire to carry freight to an American port if they are to be forced to come away in ballast, and will probably carry their freights to the nearest ports where return cargoes may be obtained, such as Vancouver. Those Americans desiring to travel or ship cargo by British ships or Japanese lines may do so by transhipping at the same port. Canada stands to gain materially by the Bill, which is meeting with a good deal of opposition in the States. The Bill has been likened to a key, which is to unlock the doors of world trade to American owners. It certainly involves co-operation between American shipowners and shipowners of other nations. Otherwise competition may become excessively severe.

BRITISH LEAD IN SHIPBUILDING.

Shipping statistics for the quarter ended June 30 last show that the total tonnage under construction in the United Kingdom is higher than it has ever been in the history of the country. The lead that America obtained as a result of the war has been lost. At the end of June last there were building in the United Kingdom 3,578,153 tons gross, an increase of 184,000 tons, compared with the position three months ago, and 1,054,000 tons more than the work in hand twelve months back. The largest increase has taken place on the Clyde. The figures for the June quarter are nearly a million and a half tons in excess of the American total. On June 30 Japan had 254,280 tons building, compared with 282,260 tons in 1919 and 95,510 tons on June 30, 1914. British Dominions also make a good showing with 268,790 tons under construction at the end of June, as against only 36,574 tons in 1914. In the aggregate, shipping is already 15 per cent. above the 1914 figure. The great strength of British shipbuilding to-day is largely due to the encouragement of private enterprise, and the rapid development has been greatly facilitated by the Admiralty's policy of extensions to shipyards. There is no occasion to fear the ability of British builders to hold their own, and their vigorous and successful policy at home will favourably influence their interests overseas.

BRITISH DOMINIONS TOURING EXHIBITION.

Particulars have been sent us of the Dominions Touring Exhibition being organised in London by the Board of Trade Department of Overseas Trade. We understand that as soon as possible the development will extend to markets in foreign countries, more particularly the Far East. At present, however, only South Africa, New Zealand, Australia, and Canada are included. The Tours are designed to be a cheap and effective medium for advertising and selling British goods abroad. The Dominions Tour will leave England early in 1921. It will travel for about two years, and the cost to exhibitors is about £210 per unit, consisting of 10 ft. frontage in the exhibition and two or four show-cases and one or two packing-cases, according to the type of unit chosen. Arrangements can be made either for a firm's local agent to take charge of their exhibits on entering a country, or a group of firms can share the cost of a joint salesman, or exhibitors may send out their own representative to accompany the exhibition. The Tour will make free use of kinema trade propaganda, which should prove valuable in showing in actual operation heavy machinery which cannot be carried about. The arrangements under this head allow of six weeks' publicity in each city and surrounding district visited. For this service a charge of £150 is quoted. Granting that the Tour is accorded, as not doubt it will be accorded, the active co-operation of commercial interests on the spot, the scheme has much to recommend it. We think, with its organisers, that it should be encouraged and fostered to the fullest extent.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

It is satisfactory to note that the engineering public is making increased use of the British Standard Specifications, for last year some 31,000 copies of specifications were sold, against about 3,000 in pre-war years. There are now some 300 committees, comprising over 1,400 members, engaged upon the Association's work. During the past twelve months 27 British Standard Specifications have been issued, and some seventy others are under revision, the most important of which, the steel sections for general building construction, including shipbuilding, has just been issued. Regarding new work which the Association has in hand, this includes, among others, the drafting of British Standard Specifications for copper alloys, steel wire ropes, steel bridge construction, and milling cutters and reamers. Probably the largest development during the past year has been in connection with the electrical industry, for which some 45 B.S. Specifications for electrical apparatus are in course of preparation. The work of standardising details in the construction of ships and their machinery is also making good progress. By co-ordinating standards, promoting efficiency, and eliminating waste the Association is doing indispensable work in promoting British engineering both at home and abroad.

COAL FROM CHINA.

The order given by the Danish State Railways for 10,000 tons of coal from China, together with the recent announcement of the forthcoming delivery of 100,000 tons of Chinese coal to Marseilles, marks, we sincerely trust, the beginning of a fresh development in the export trade of China. If her coal resources are adequately exploited, China is better placed to export cheap than any other country in the world. Industry in many countries is to-day heavily handicapped through lack of cheap fuel. China is splendidly placed to supply this need. Those in China connected technically or commercially with her coal mining industry have an opportunity for practically unlimited development offered them. Coal is found in every province in China, and a recent estimate made the coal measures of the Chinese Republic 417,000 square miles. The coal beds of the Shansi alone are sufficient to supply the requirements of the whole world for many hundreds of years to come, and China, in the aggregate, has four times as much anthracite as the rest of the world put together. For the greater part, her coal mines are easily worked and cheap labour is available. These last-named factors gives China great advantages over America and other coal-producing countries. Outside the Far East, the enormous extent of China's coal resources are not realised, although on the Continent and in Great Britain more attention is now being given the matter. The assured prospects of cheap coal from China have consistently received publicity in this Journal. We believe that no development is better calculated to add to the prosperity of China or to satisfy the urgent requirements of other nations. By purchasing China's raw material, moreover, other countries will finance and enable China to import on an augmented scale their finished and manufactured products.

GERMANY AND THE FAR EAST.

Evidence is accumulating both as to the nature and volume of German competition likely to be encountered in the Far East. This is likely to be particularly far-reaching in highly-finished manufactures. The necessity for maintaining in impoverished Germany a population far too numerous in proportion to the agricultural production renders it necessary for raw and semi-finished materials to be converted into the most highly finished goods to the greatest extent and then exported, so that foreign purchasers pay for as much German labour as possible. Such is Germany's policy to-day.

Germany is placing considerable dependence on Japan as a market for German goods and on her ability to secure a share of Japan's trade with other countries. A German business man recently returned from Japan is reported to have said at a Berlin meeting that at the present time it would not be at all difficult to compete with Japanese goods because of their bad quality. The difficulties of competition would, however, grow steadily greater in view of the control which the Japanese Government is exercising over exports. Further, Japanese manufacturers will have an unassailable position if they continue to inundate Siberia with goods of all kinds without paying Russian import duties on the plea that they are sending war supplies. The Japanese are also obtaining supplies of raw materials from Siberia at extraordinary low prices. In the past German interests have been well represented in Japan, a condition which is being rapidly resumed. According to a report from Wesel, Germans who have recently returned from Siberia announce that, at the request of about 700 German prisoners of war from Siberia, mostly technical men and trained workmen in the electrical industry, the Chamber of Commerce of Tokyo a little time ago recommended the Government to permit these Germans to remain and receive employment in Japan. They are said to have been given employment in railway construction and in the electrical industry, and occupation has also been given to German textile experts who were among the prisoners.

The position of China from the point of view of the German manufacturer was recently outlined by Herr Strewe, a member of the Chinese Union of German Engineers. Remarking that the industrial position had turned the attention of the Germans to Russia, Central Asia and China, the speaker pointed out that the development of the mineral resources of Asia promised an enormous addition to the raw material resources of the world, and would mitigate Germany's difficulties. Even if the materials did not reach Central Europe, their appearance in the market would depress the world's prices. Thus an important new problem arose in the co-operation of Germany in the process of the industrialisation of the Asiatic countries. The process would require the supply of an immense quantity of materials and machinery. That was a development of the greatest importance for German industry, which, owing to the scarcity of raw materials, would have to concentrate on the production of highly valuable manufactures in the future. Estimates received from China showed that Germany could now sell machinery at high profits even if foreign competitors offered lower prices, as the demand for machinery in China and Japan provisionally was considerably greater than the possibility of delivery by the countries interested in the Far Eastern markets.

The engineering schools established in China have been lost to Germany through the war. That at Shanghai is now associated with the French University and that at Tsingtao has passed into Japanese hands. In the more recent developments of technical school training, however, the Chinese show an increasing sense of the value of retaining the schools in their own hands, and in this way there is a prospect for German engineers, chemists, and representatives of other sciences to take an active part in the Chinese schools. The best method, however, according to Herr Strewe, for obtaining the favour of the Chinese, and at the same time ensuring the necessary influence of Germany in connection with the industrialisation question, is to permit China to participate in the technical, scientific and industrial development with Germany. This can be done by Germans teaching in Chinese schools, by Chinese attending German schools, or by the translation of German technical works for the use of the Chinese. That the Chinese appreciate the activity of German engineers was shown, according to the same authority, by the fact that a number were permitted to occupy influential positions in their country during the war, and were still at work there.

Elsewhere in the Far East, more particularly in the Dutch East Indies and Siam, Germany hopes to do well. British interests in these latter countries, indeed, regard German competition as likely to prove eventually more formidable than American.

American competition, however, is in no way underestimated in Germany. In certain industries this is particularly so. The motor industry is a case in point, where the weak financial position of many German companies will probably not enable them to deal successfully with American enterprise. Colour is lent to Germany's anticipations by the activity shown in America in engineering a controlling interest in German and foreign motor works. German makers frankly admit their belief that in the course of the next few years America will have such a surplus of cars that they will be forced to throw them on the markets of the world at unremunerative prices.

In other directions, however, Germany feels more sure of her position. In electrical engineering her manufacturers, indeed, anticipate supremacy. They do not admit as much either to native labour or to their foreign competitors, but it is understood that those best able to judge regard the future with great confidence. Germany's exports are, of course, prejudiced by the Government Departments' control over prices and by the refusal of German manufacturers to give binding offers either in the matter of prices or time of delivery. In the meantime the production of coal is making great headway in Germany, and the output of lignite is greater than at any period in the existence of the country. Production of pig-iron has increased sufficiently fully to meet requirements, and steel makers are also apparently satisfied with their position. Wherever conditions are such as to give Germany confidence her endeavours to extend her export trade will be directed largely towards the Far East. Considering the immense potential requirements of this part of the world for machinery and equipment it cannot be said that Germany's endeavours are unwisely directed. In nearly all industries where Germany's export trade has an assured future, her position has been strengthened by amalgamation and co-ordination. Complete financial fusion may not be general as the extraordinary high taxes and fees and the corporation law tax render whole mergers and amalgamations excessively costly proceedings. But for all practical purposes of securing overseas business the working arrangements which have been arrived at secure the same results as complete amalgamations. They also escape undue publicity, and Germany has freely utilised their advantages in equipping her industries to meet foreign competition.

CAMPHOR FROM TURPENTINE.

The position of the camphor industry in Japan has been dealt with from time to time in these pages, and the restriction in the supply of camphor allotted to America by the Japanese Government has been noted. It is now reported that in consequence of the inadequate supplies thus allotted and of the high price, three large chemical companies in the United States have begun the extensive manufacture of camphor from turpentine. As a result of the war and of the high cost of labour, spirits of turpentine is quoted at about four times the price of pre-war days Although it is improbable that turpentine can ever be made profitably at the old figure, it may decrease in price sufficiently to give synthetic camphor factories a safe margin on which to fight the Japanese trade. It has been known for years that a grade of camphor closely resembling the Japanese variety could be made from turpentine. It is only recently, owing to commercial conditions, that the manufacture of synthetic camphor has been instituted on a large scale. As approximately nine-tenths of all the turpentine produced in the world is distilled in the United States, chemists believe that the manufacture of American camphor will develop into a large industry.

A NEW CRUDE RUBBER.

It is reported from California that rubber of very fair quality, called "Chrysil" rubber, and in large quantities, may be obtained from the *Chrysothamnus nauseous* (rabbit bush). It is stated to be of high grade, good average quality, not, indeed, as good as Para, but superior to most Africans and low grade rubbers. It is suggested in America that if the sources of rubber extraneous to the States were cut off, or if the price of normal grades rise excessively, the plant would provide America with a reserve equal to 300 million pounds, or sufficient to "carry on" with for some little time, even at the present rate of consumption. The bush is said to grow over vast tracts from sea-level up to 8,000 ft. in the Colorado mountains. It is most prolific in northern and central Nevada, in Utah and Colorado. The bush is laticiferous. It takes three or four years to attain maturity as regards rubber extraction, and the average weight of the rubber-bearing parts of the bush are from 5 to 15 pounds, ranging up to 60 pounds occasionally.

ENGINEERING, MINING AND INDUSTRIAL PROJECTS IN THE FAR EAST.

THE NEW HARBOUR FOR TOKYO.

In view of the ever-increasing cargo for Tokyo, as well as of the keen appreciation of prices, the Tokyo Harbour Construction Commission recently decided to construct an outer harbour off Haneda, a town at the mouth of the River Kokugogawa, which forms the boundary between Tokyo and Kanagawa Prefecture. This was projected under a previous scheme, but there are important differences in the present plan. Whereas the outer harbour and the inner (main) harbour were to be connected with a canal running from Haneda to Tsukishima, according to the old plan, the new plan is to construct breakwaters one mile off the coast from Haneda to Shinagawa. Inside the breakwaters, waterways, berths, and jetties will be constructed. About 80 per cent. of the cargo which enters and leaves Yokohama is destined for Tokyo. Tokyo handles about 7,840,000 tons of cargo every year. But it is estimated that the value of cargo to be handled ten years hence will be in the neighbourhood of 12,000,000 tons. Harbour construction has thus been projected to meet this situation. Piers for the coastal service will be constructed at Tsukishima and Shibatra; three for the ocean service at Oiyachi (town between Oomori and Shinagawa), and those for the passenger service at Shinagawa. The breakwaters to be constructed off Shinagawa will be large enough to allow motoring. Provision will be made for single railway connections to be established between those piers and the main lines.

RAILWAY ELECTRIFICATION IN JAPAN.

The railway authorities in Japan now propose to substitute electricity for steam on most lines. A Bill will be brought forward during the present session of the Diet. It is proposed to reduce the number of locomotives by 40 per cent. The estimated cost of the scheme is 200,000,000 yen.

CHINESE SHALE DEPOSITS.

According to Dr. Iki, the Japanese scientist, there are large quantities of oil shade in the neighbourhood of Fushum, China, and the deposits so far examined are estimated to contain over 1,000,000,000 tons of workable oil shales. These shales to a great extent overlie the coal measures, and they are so near the surface that it will be unnecessary to mine them by ordinary mining methods, the work taking the form of excavating. Dr. Iki urges that these deposits should be commercially worked, in view of the large consumption of oil products in China and the growing difficulty of supplying needs from the United States.

CONTRACT FOR CHIHLI RAILWAY.

It is understood that the preliminary contract to build, equip and finance a railway line in Chihli from Tsangchow to Shihchiachuang, connecting the Tientsin-Pukow with the Peking-Hankow and Shansi lines, signed on June 1, was made with Italian interests represented by Mr. E. M. li Villa. The line has been surveyed, plans drawn up, and estimates of traffic receipts made out by the railway company, but these have to be checked. The provisional agreement, which gives the concessionaires six months' option, wherein definitely to decide whether they will undertake the work, fixes the capital outlay at $10,000,000. According to present plans, the length of the line would be 455 li, and it is estimated that the construction can be completed in three years.

NEW OILFIELD IN FORMOSA.

The Japanese Navy, which has been busy for several months searching for possible centres of oil fuel production for the needs of its fleet, has just discovered what promises to be a very important oil pool in Formosa. The Navy is dispatching a large number of men to the spot, in order, first, to test the limits of the pool, and then to operate it commercially. This is the first petroleum region found in the southern part of the island colony, and its acquisition means much to the petroleum industry of Japan. It is also important to the Japanese Navy, which has hitherto been largely dependent upon Borneo and the United States for its heavy oil requirements.

MOTOR TRACTORS IN FORMOSA.

To give some idea of the opening which may exist for the sale of agricultural tractors, it may be mentioned that the area under sugar-cane in Formosa, in which industry agricultural motor tractors have shown good results, is, in an average year, about 250,000 acres. There are probably over thirty companies, with a capital of not less than 1,000,000 yen each, engaged in the sugar industry. The aggregate authorised capital of these companies is over 200,000,000 yen, one-half of which has been called up. One company has an authorised capital of 40,000,000 yen, and three others a capital of 25,000,000 yen each. Nearly all the older-established concerns have been making enormous profits during the past few years, and the present is an excellent opportunity for pushing the sale of modern appliances and machinery. Competition, however, will become increasingly difficult as time goes on.

Agricultural motor-tractors were first used on sugar plantation work in the early summer of 1919. At present there appear to be about twenty of such tractors in use in the island. All are of American manufacture, and range up to 75 h.p., so far as has been ascertained. They were imported through the medium of a British firm. Two of the sugar companies have more tractors on order, and it is understood that a third is also about to make use of them. Those companies which have tractors already in use seem to be well satisfied with them, and it is probable that a good number of the other companies will follow suit in the course of time.

CO-OPERATIVE OIL FACTORY FOR SUMATRA.

Several of the Sumatra plantation companies have been considering a proposal for the erection of a local oil factory, to be run on the co-operative principle. It is being pointed out that the increasing interest taken of late in the planting of oil palms favours the establishment of such a factory. In the case of copra, the treatment on the spot should constitute a considerable advantage, if only from the point of view of the saving in freights. Palm oil will become a speciality of the East Coast of Sumatra, where large plantations are just coming into full bearing, and important new layouts are being planned, because the initial experience shows larger profits than on coconut estates.

VEGETABLE OILS IN NETHERLANDS EAST INDIES.

The Netherlands East Indies Chamber of Commerce in London publishes some interesting particulars of the vegetable oils industry in the Netherlands Indies, where the industry centres largely on Java. The principal oil-producing concerns are:—The Insulinde Oil Mills of Amsterdam and Bandoeng, with eight mills and two refineries. It owns tank installations at the mills, and the principal shipping ports, tank cars and tank steamers. A subsidiary controls a tank installation at San Francisco. Total capital and reserves amount to £3,500,000. Anton Jurgens' Margarine Works of Nymegen-Sourabaya controls four plants, while more are being planned. This company, through its affiliations in most civilised countries, is a leading distributor of artificial butter. The United Java Oil Mills of Sourabaya, with three mills and a capital of £300,000, is another large company. Van Dongen's Oil Mill at Blitar, Java, is going to increase its capital to £250,000, by a new issue for the installation of a second large plant. Then there are the Co-operative Oil Mills Sedia Madjoe, the first experiment to induce the native to produce a better quality of copra by giving him a share in the sale of the finished product. The initial capital is £65,000. The Slamat Oil Mill of Messrs. Douwenhorst, Mulder and Co., at Tjilatjap, on the South Coast of Java, is the only mill operating with water-power, all the other plants being driven by electricity.

The Sourabaya Oil Mill of the Java Overseas Co. is working on copra and kapok seeds. Further, at Pontianak, West Coast of Borneo, are the Wilhelmina mills and the mills of Hemmes and Co., both controlled by Chinese, with a capacity of over 500 tons crude oil per month.

The Insulinde Oil Mills crushed in 1916 51,000,000 lbs.; in 1917, 100,000,000 lbs.; in 1918, 125,000,000 lbs. It possesses two tank steamers of 9,000 tons each, while a third of 10,000 tons is in course of construction. The capital is about to be increased to £2,500,000.

PROSPECTS BEFORE OIL PALM CULTIVATION.

In view of the projects for oil palm cultivation now under consideration in the Far East, special interest attaches to the opinion of Mr. E. J. Hammond, of the Java Investment Loan and Agency. Mr. Hammond believes that if the planting of oil palms proves to be as successful and profitable as many well-informed people now anticipated, then very large areas in the East are certain to go in for this form of cultivation, and the effect on the rubber industry will be that land, capital, and enterprise, which otherwise would be devoted to the further planting of rubber, will be devoted to oil palms, and so the time when production of rubber might possibly overtake consumption may be further postponed. A discussion of the position with people identified with the rubber and vegetable oil trades elicits the view that the great question to be decided is whether the cost of labour in the countries where it is proposed to cultivate palm nuts will enable the growers to compete with the trade in wild nuts that grow in unlimited quantities in Africa. The rubber industry has rather tended to show that the planted tree ultimately knocks out the wild tree, and it remains to be seen whether that takes place in the case of the palm nut. In the matter of transport facilities and climate—the latter looked at especially from the point of view of the white man—the Middle East has manifest advantages over the wilds of West Africa, but cost must be the final factor.

NEW STEAMSHIP SERVICE BETWEEN CANADA STRAITS SETTLEMENTS, AND INDIA.

A message from the Department of Public Information, Ottawa, states a new steamship service is being organised by the Houston Lines from Montreal to the East, calling at ports in India, Burmah, the Straits Settlements, Samarang and Sourabaya. The service is to be started this month.

MOTOR TRACTORS AND CYCLES IN MALAYA.

The scarcity of labour on the rubber estates, and the almost prohibitive cost of weeding by manual labour under the present wage scales, together with the increasing production of rice, is increasing the popularity of farm tractors in British Malaya. Consul George L. Logan, at Penang, however, cautions manufacturers that the possibilities of this market cannot be realised unless all parts of the tractors are correlated and ploughing and other modern equipment carefully adapted to the local soil and other conditions. These factors should receive prompt attention in order that the present keen and widespread interest may not be subjected to disappointing demonstrations.

It is reported that dealers in motor cycles in British Malaya are finding it difficult to obtain enough machines of either American or British manufacture to meet the growing demand. A conservative estimate places the number now in this territory at from 3,000 to 3,500, varying from 1¼ to 12 h.p., with from one to four-cylinder engines. The type most in demand is a light-weight, high-speed motor cycle from 2¼ to 4 h.p., while those carrying side-cars vary from 4 to 6 h.p., ranging in price from 200 dollars to 625 dollars.

For use on the soft roads of the plantations the lighter machines are preferred. Twin cylinders are preferred both in the heavy and light machines.

INDUSTRIAL PROGRESS IN BRITISH NORTH BORNEO.

Abundant evidence was forthcoming at the recent meeting of the British North Borneo (Chartered) Company as to industrial development which now characterises this territory. The most welcome feature is the increased value of exports, amounting last year to as much as 42 per cent. The rapid expansion of the rubber industry is demonstrated by the increase in the quantity of rubber exported, namely, 3,000,000 lb. The area under cultivation has risen from 40,986 acres to 47,739 acres, an increase of over 16 per cent. Confidence in North Borneo as a rubber-producing country has been completely justified. A new company 's about to be floated which has secured a concession of 100,000 acres, and towards the capital of which the Chartered Company will be large contributors. The next important industry is timber, to exploit which a large company has been formed. Excellent progress continues to be made by the Cowie Harbour Coal Co., in connection with which there has been a reorganisation of capital. The other products of the company also show progress, and new industries are contemplated. Labour troubles have so far been non-existent, and are not anticipated in the future. A State Bank has been established. The principal works which are to be undertaken during the current year are the construction of the grand trunk road from Sandakan to Jesselton and the important road from Jesselton to Tauran, both suitable for motor traffic. There are also much-required waterworks at Sandakan and elsewhere; a new Customs House has to be built at the same place, and other works of magnitude are in contemplation. Irrigation will not be overlooked.

THE HEAT TREATMENT OF STEEL.

In a further article on this subject, published in Messrs. Edgar Allen and Co.'s journal, the treatment of special steels is dealt with and some useful and exact information is given on case-hardening methods in addition to a general *résumé* of modern practice in this connection.

The usual method of case-hardening is to pack the steel in iron boxes, taking care that the steel is completely surrounded by the case-hardening compound. The box, with its contents, is then heated to the temperature proper to the particular steel and held there until it is judged that sufficient time has elapsed to secure the desired thickness of case. Uniform heating is most necessary, and considerable experience is essential to secure correct results. In an alternative method the steel to be case-hardened is heated to a red-heat and the carbonising compound then added. By this means the time of heating is greatly reduced, and the uniform heating obtained in this way ensures the minimum of distortion.

CASE-HARDENING MILD STEEL.

The simplest type of case-hardening steel is a plain mild carbon steel, the low carbon percentage allowing it easily to be case-hardened, leaving the core, after suitable heat treatment, in the toughest condition. For the actual hardening operation pyrometers only should be used, and the muffle furnace should always be employed in preference to the open fire. Good case-hardening compounds, consisting of either bone or leather, are recommended for this steel. In regard to heat treatment, the following general instructions are given: Carbonise at 880-950 deg. C. and allow to cool. Reheat to 880-900 deg. C. and quench in water or oil. Then reheat again to 760-780 deg. C. and quench in water or oil. This method ensures an extremely hard case with the toughest possible core.

NICKEL STEEL.

The best general treatment for 3 per cent. nickel case-hardening steel is to carbonise at 850-900 deg. C. and allow to cool. Then heat up to 840-860 deg. C. and quench in water or oil. Reheat to 750-770 deg. C. and quench again in oil or water.

Nickel steels do not become so brittle as carbon steel when subjected to prolonged heating at a high temperature. Owing to this the steel is better able to resist fracture by sudden shock. Further, the carbon is more uniformly distributed in the carbonised zones of nickel steels, thus giving a less firm dividing line between them, which means that the case is less likely to chip or flake. Finally, the critical ranges of these steels are lower than in carbon steels, and a correspondingly lower case-carbonising temperature may be used.

The advice given relative to 40-ton steel, which is a special Siemens-Martin steel, with a tensile strength of about 40 tons per square inch after heat-treatment, states that this steel improves in toughness as a result of judicious heat-treatment. In particular it will be found that normalising after forging greatly strengthens it. It is not a difficult matter to heat-treat this steel. Quenching has to be well and thoroughly done if it is to be effective, and sometimes, when quenched in large masses, the steel suffers from a lack of uniformity. The best and safest procedure is to heat to 830-850 deg. C. and quench in oil or water. Then reheat to 550-600 deg. C. and cool off in water.

3 PER CENT. OIL-HARDENING NICKEL STEEL.

When quenched in oil at 850 deg. C. (1,582 deg. F.) and tempered at 550-600 deg. C., it gives 45-60 tons tensile, 32-40 tons yield point, 20-18 per cent. elongation, and 50-45 per cent. reduction of area.

NICKEL CHROME STEELS.

These steels are perhaps the best all-round alloy steels at present in use. They combine the advantages of both nickel and chrome steels with the disadvantages of neither. Their heat-treatment does not offer any serious or new difficulties. Like nickel steels, they are not very harmfully affected by prolonged high temperatures. A very fine grain may be produced by careful methods, and correct annealing (below the change point) will also produce a similar effect. Here, again, the critical ranges of nickel chrome steels being lower than those of ordinary plain carbon steels, lower quenching temperatures may be adopted. Heat to 820-840 deg. C. and quench in oil. Reheat to 550-600 deg. C. and cool quickly in air, or preferably quench in water. The treatment may be varied according to the tonnage required. Machine after treatment.

THE directors of the Han Yeh Colliery Co. at Nganyuen, in South China, have decided to devote a proportion of the profits to the education of miners' children.

THE NEW 100-TON BLAST FURNACE OF THE YANGTSE ENGINEERING WORKS, LTD.

By the courtesy of Mr. Wong Kwong, general manager of the Yangtse Engineering Works, Ltd., at Hankow, we are enabled to publish the following description of the new 100-ton blast furnace which was officially opened on June 26, and was blown in on May 22 last:—

The furnace is designed to produce 100 tons of sand cast pig-iron per day. It is supported by six cast iron columns, has six tuyeres, and is lined with fire-bricks purchased from the Kailan Mining Administration, Tientsin. The cast house is about 50 ft. span and 100 ft. long, with steel columns and iron roof.

Bosh cooling is effected by sprays held on the steel plate jacket by plate strips. Also, in addition, there is one row of copper bosh plates immediately above the tuyere line. There is no cooling above the mantel, but a permanent spray pipe is installed on the shell to take care of any possible hot spots that may be developed in the future.

The furnace top is of the double bell stationary type, and is served by a single skip counter balance weight through a balancing tower at the bottom near the hoisting engine. There are two sets of horizontal hoisting engines (one for spare), each with double high pressure cylinders 12 in. dia. by 20 in. stroke, designed and built by the Yangtse Engineering Works.

There is one primary dust catcher of ordinary type and one centrifugal whirler for cleaning gas for stoves and boilers.

Filling on the bottom is by means of buggies for ore, limestone and coke. Cast-iron plates form the floor of the stock house.

The blowing equipment consists of two horizontal connected cross compound engines and one tandem compound engine. As during the time of war it was impossible to purchase any blowing engines, the steam end of these engines was purchased ex stock abroad, while the air end was designed and made in the Yangtse Engineering Works, being equipped with plate valves of the Allis Chalmers type.

Air for blowing engines is taken through two cylindrical containers arranged and cooled similar to a surface condenser with air conduit to the three blowing engines. This is calculated to precipitate moisture and afford a drier blast, especially in the hot summer weather, when the atmosphere is high in moisture.

Two surface condensers, each about 1,200 sq. ft. condensing surface and calculated to give 25 in. of vacuum, have been installed.

In the boiler house are four boilers of the water-tube type, each of 1,500 sq. ft. of heating surface and 150 lb. working pressure, provision being made for two more. They were designed and built by the Yangtse Engineering Works, as were also the gas burners of Peaton type. Condensate from the condensers is filtered and used for boiler feed water, with provision made for "made up" water from the water tower. There are two Weir pumps for feeding boilers and two horizontal Worthington pumps for general and fire services. The latter have connections for feeding boilers in case of need, and for pumping direct to furnace bosh and spray cooling and cast house, so that in case it is found necessary to cut off water supply from the tower these two pumps will be sufficient to keep the furnace going.

Boiler feed water is heated by exhaust steam from the service pumps.

The main water supply flows from a large settling pond at the back of the Yangtse Engineering Works by gravity through an 18 in. cement pipe line, and is pumped to the water tower by two horizontal steam pumps. Either one of the above two pumps is calculated to furnish sufficient water supply, the other being a spare.

All discharge water from the condensers, stoves, furnace, etc., is returned through deep drains back to the settling pond or to a cooling pond near the water tower, and is used over again.

Ample filters have been installed to ensure clean water for all purposes.

The water tower, which is of reinforced concrete, is 115 ft. overall, and has a capacity of 80,000 gallons, sufficient for future plant extensions.

The handling of raw materials from the bund to stock-yard is rendered exceedingly difficult by reason of the difference of 45 ft. to 50 ft. between high and low water in the Yangtse River. While at present manual labour is employed as a temporary measure, this condition will be taken care of by the installation of rope haulage electrically operated.

A steam generating set is on the way coming out from England, and will be installed in the main engine house. This equipment is to run on steam from the main boiler house, and will furnish power for the whole works, allowing the present generator equipment to be held in reserve.

The buildings are:—

A three-storied brick building for combined purpose of office, laboratory and living quarters.

A blowing engine-house of brick and reinforced concrete roof, 50 ft. by 90 ft., equipped with a 10-ton overhead travelling crane.

The condensers building at the south-east end of the blowing house separated by a curtain wall, being built also of red brick with reinforced concrete roof.

The Yangtse Engineering Works' new 100-ton Blast Furnace: General View

A boiler house of red brick, and reinforced concrete roof, 40 ft. by 95 ft.

A hoist house of brick and cement face and red tiled roofing.

A haulage house near the shore of the same construction.

Other suitable buildings for housing coolies, workmen, and for men around the furnace are also installed.

The Yangtse Engineering Works Co. wish us to mention that the iron ore used by the company at first was from the Pao Hsing iron mine near Wuhu, but in future the company will draw its supply from the Elephant Nose iron mine at Tayeh worked by the Hupeh Mining Bureau, the preference being on account of its proximity to Hankow. Coke is obtained from Liu Ho Kou mine. The company now only manufacture foundry iron, of which the following are the presentative analyses:—

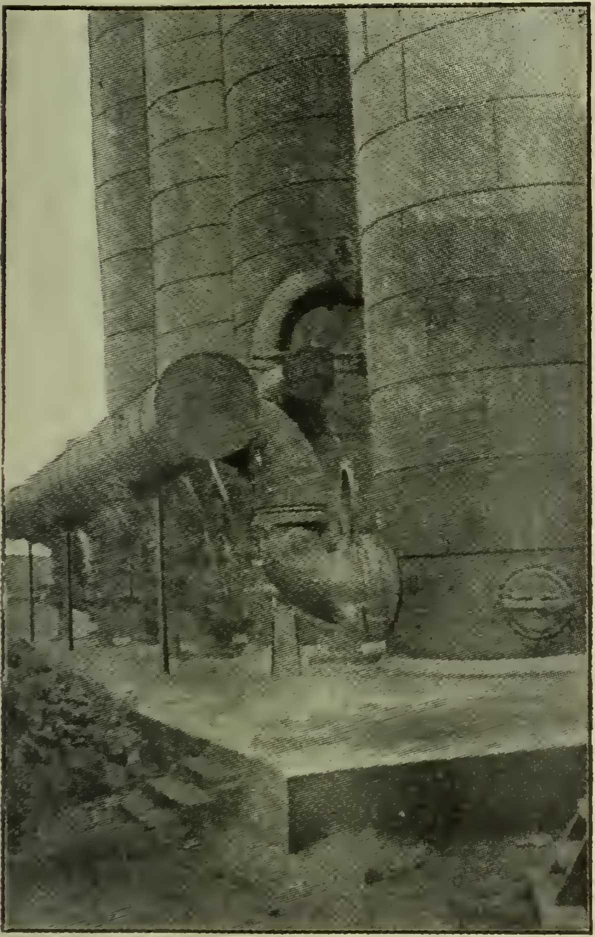
	No. 1.	No. 2.	No. 3.
	%	%	%
Silicon ...	2.0 —3.0	1.5 —2.0	1.0 —1.5
Sulphur ...	0.01—0.02	0.02—0.04	Less than .05
Phosphorus	0.5 —0.6	0.5 —0.6	0.5—0.6
Manganese	1.0 —2.0	About 1%	About 1%

Mr. H. R. Cameron and Mr. T. D. Smith have been elected to the board of Smith's Dock Co., Ltd.

According to a Berlin paper Japan has placed orders with German firms for several million marks' worth of highly-finished steel sheets.

The Consolidated Steel Corporation of New York has opened an office in Shanghai.

IMPERIAL WIRELESS COMMUNICATION.



Hot Stoves and Chimney Valves to new Blast Furnace, Yangtse Engineering Works.

The full report, now available, of the Imperial Wireless Committee appointed to prepare a complete scheme of Imperial wireless communication deals with the proposition from the point of view of commercial utility. The distances comprised contemplated, unnecessarily, links of about 4,000 miles each. For these distances all spark systems are obsolete, and the high-frequency detonator is as yet costly, difficult to repair, and insufficiently tested. Therefore, the use of the arc system might be suggested, but it is not possible to say beforehand what power would be required to allow of a capital cost and annual expenditure such as could be rendered self-supporting at attractive traffic rates. Moreover, the possibility that the arc system is obsolescent must not be overlooked. The chief countries of the Empire can, however, be connected by links of about 2,000 miles, a range that can be covered by the employment of thermionic valves. A combination of the arc system as now installed and of the valve system, which is undoubtedly in the line of future development of wireless telegraphy and promises to cost less than the arc system to install and operate, is therefore recommended by the Committee.

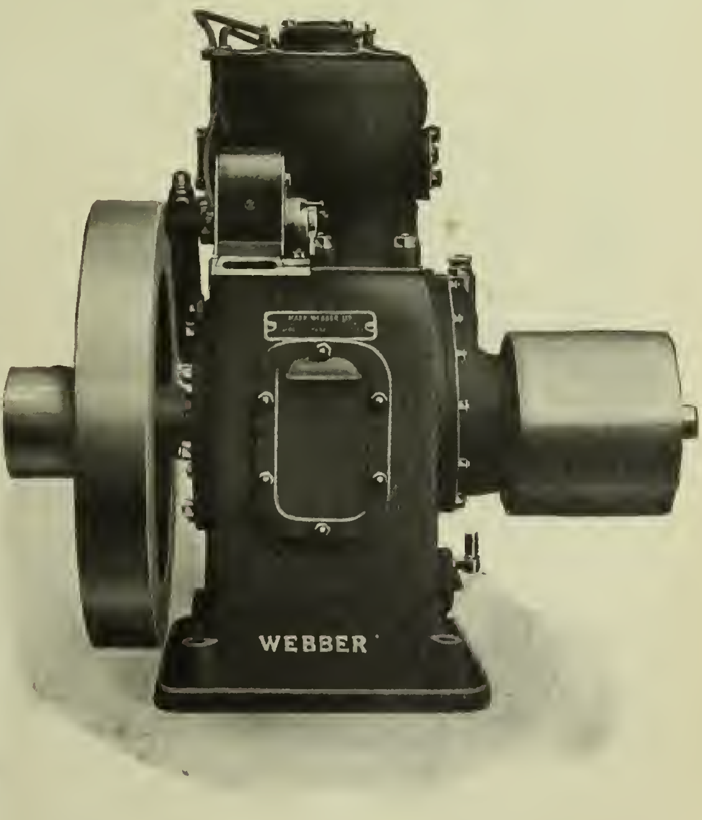
For the Indian, Far Eastern and Australian service it is proposed that valve stations should be erected in England, near Cairo in Egypt, in India, at Singapore, at Hong Kong, and on the north and west coast of Australia. Communication between England and Canada can be secured by similar valve stations in each country, but a satisfactory commercial service between Western Canada and Australia is regarded at the present stage of development as to be beyond practical consideration. The capital cost of the scheme is estimated at £1,243,000, of which £853,000 would be payable by the Imperial Government. The annual charges, including interest on capital at 6½ per cent. and amortisation of plant, etc., within a proper period, are estimated at £425,000, of which £268,000 would fall on the Imperial Government. Annual traffic is put at 10,000,000 words, yielding £325,000, of which £205,000 would be receivable by the Imperial Government. The initial loss anticipated in the opening years is divided between the Imperial, Indian, Australian and South African Governments.

HIGH EFFICIENCY INTERNAL COMBUSTION ENGINES.

The potentialities of the market in the Far East for internal combustion engines are amongst the most apparent openings for trade this part of the world offers British manufacturers. An indication of the demand in China is forthcoming in the endeavours made here during the war for the country to supply in some measure its own requirements. The results achieved in most cases, however, do not represent serious competition, despite the low price at which such engines were put upon the market. In many cases the cylinders and pistons were constructed from No. 3 black Indian pig-iron, being so soft that the cylinder could be scratched with a common wire nail. There has been no uniformity in cylinder dimensions, due to unscientific methods of boring. The pistons fit poorly, the ring grooves are not square, and the rings are not surfaced to fit the grooves properly. In these circumstances the engines give constant trouble, do not develop the power for which they were guaranteed, and require an extravagant amount of fuel and lubricant. These discrepancies are shown up in sharp contrast by the British engines. This is particularly the case if the comparison be made with the class of engine described in this article which has recently been put on the market by Messrs. Mark Webber, Ltd., of Guildford, Surrey. In the machines produced by these makers, machinery users have an engine of great economy and simplicity, the design and construction of which it is well to consider, as in such high-class products we probably have the best weapon for meeting foreign competition in the Far East.

The "Webber" engines were specially designed for the manufacturers by Mr. H. R. Ricardo, the well-known authority on internal combustion engines. They run on petrol, paraffin, or gas, and are made in two sizes—single cylinder 5-9 h.p., and twin cylinder 10-18 h.p. The main object of the design was to produce a simple and inexpensive engine for general purposes, such as dynamo driving, farm work, pumping, etc., and at the same time to obtain the high efficiency which has hitherto been secured with more costly engines, such as those used for aircraft. The results given below, which were obtained from exhaustive tests, show how well the objects aimed at have been achieved.

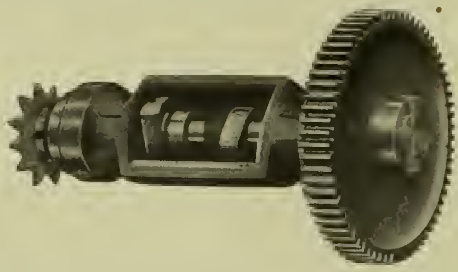
General views are given of higher power engines, both stationary and marine types; also illustrations of one or two of the more interesting mechanical details. The engines are of the vertical four-cycle type, with 4 in. bore and 6 in. stroke. In both design and manufacture every effort has been made to reduce mechanical losses to a minimum. The piston fricton is reduced by the use of the Ricardo aluminium slipper piston. This is about one-half



The 10-18 h.p "Webber" Engine.

the weight of a cast-iron piston, the power is increased by 10 per cent. at 750 r.p.m., while the fuel consumption is reduced by 10 per cent. at this speed, and the oil consumption by about 60 per cent. The noise is no more than with a well fitted cast-iron piston, whilst the engine will run about 60 per cent. faster with the same amount of vibration. It is also claimed that the engine will run from two or three times as long without requiring decarbonising, as this type of piston is very effective in preventing the passage of oil to the combustion space. As compared with an aluminium trunk piston, the weight is 30 per cent. less, power increased by 5 per cent., fuel consumption reduced by 5 per cent., and the oil consumption by 33 per cent. The engine will run twice as long without decarbonising, and 25 per cent. faster for the same vibration and with elimination of piston slap. Wear is considerably reduced by using a floating gudgeon pin.

Cylinders are off-set from the crank-shaft to reduce pressure on the cylinder walls and tendency to back-fire. Castings are tested up to 400 lbs. per square inch for the cylinder bore and 75 lbs. per square inch for the water jacket. In the higher power engine the twin-cylinder is cast-monobloc. Cooling is by natural circulation from a water tank conveniently situated The valves are arranged at the side and the springs and tappets are enclosed in the conventional manner. This method was adopted after much experimental work, when it was found that a combustion head could be produced with valves at the side which would give an efficiency practically equal to that of an overhead valve engine without having the objections attached to this type. The Ricardo masked inlet valve which is installed is a combination of a piston valve and an ordinary seating valve. Its action affects a very rapid cut-off and obtains a high volumetric efficiency by preventing the loss of gas during the early part of the compression stroke. It also makes possible the use of very light valve springs, reducing noise and wear.



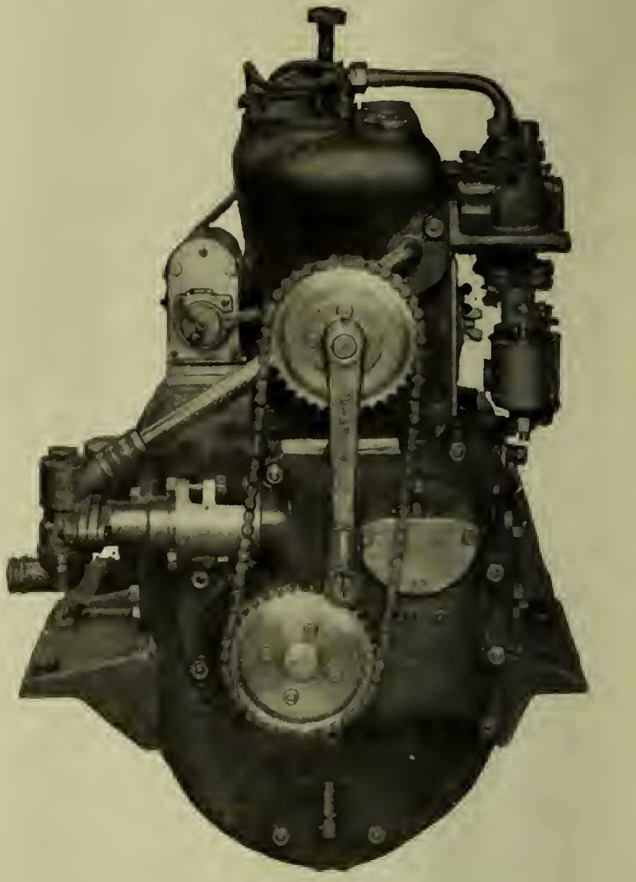
Showing novel manner of lubricating cams and valve gear, the Camshaft being carried in Iron Trough which receives the oil flung out from the connecting rod big-end.

Forced lubrication is provided to the big-end bearings by means of an oscillating plunger pump operated from an eccentric on the crank-shaft. The two main crank-shaft journals having ball-bearings require no pressure lubrication. In the lubrication of the cams and valve gear the cam-shaft is carried bodily in a cast-iron trough open at the top. The oil flung out from the connecting-rod big-end bearing is thrown into this trough, so that the cams and their bearings are almost completely immersed in oil. The overflow feeds the timing gears and governors and returns into the crank-case sump.

The "Ricardo" Patent Aluminium Slipper Piston.

An efficient centrifugal governor is mounted on one end of the crank-shaft. A small speeder spring is provided on the throttle lever by which the speed can be raised or lowered about 20 r.p.m. above or below the normal governed speed. There is also a hand-control on the throttle, so arranged that the speed can be reduced to about 200 r.p.m., but it is impossible to increase the speed without disconnecting the governor control gear. The governor can be set for any desired speed, and will maintain this speed with a variation of less than 3½ per cent. between full load and no load, and with the least tendency to hunt.

For running on gas the Ricardo patent gas-mixing valve is fitted. The Zenith carburetter is used for running on petrol and the recently-patented Zenith-Ricardo carburetter for running on paraffin. All parts of the engines are interchangeable and are extremely accessible, and the engines are designed to run at any speed up to 1,100 r.p.m.



10-18 h.p. "Webber" Marine Engine.

In the tests made on single-cylinder engine 900 r.p.m. was found to be the most efficient speed.

The tests mentioned showed that the b.h.p. developed by the 5-9-h.p. engine was 4.8 at 500, 8.84 at 960, and 10.5 at 1.100 r.p.m. Fuel consumption showed the low figures of:—Petrol, 0.60 pint per b.h.p. hour; paraffin, 0.68 pint per b.h.p. hour; gas, 17 cubic feet per b.h.p. hour, from coal gas, calorific value 600 b.t.u.'s. Oil consumption was 0.012 pint per b.h.p. hours. Close governing was obtained from full load to no load, with a variation in speed of less than 3½ per cent. The mechanical efficiency was 90 per cent. at 600 r.p.m A wide range of power is obtained; the 5-9-h.p. petrol engines give any power from 5 h.p. to 9 h.p. and the 10-18-h.p. engines from 10 to 18 h.p. The high efficiency and low fuel consumption are maintained at any of these powers.

SOURABAYA HARBOUR IMPROVEMENTS.

Recent improvements to Sourabaya Harbour are to be supplemented by a further deepening of 3 ft. 2 in., which, with the improvements already effected, will permit ships of 29ft. 6 in. draught, when fully loaded, to enter and leave at high water. Even an additional deepening of 3 ft. 3 in. for still larger vessels is advocated. The existing harbour works include a large quay 4,000 ft. long and 656 ft. wide, with quay walls for buildings on the north side of the left bank of the Kali-Mas, dredging an inner harbour of 247 acres to a depth of 8 ft. 2½ in. below low-water level, together with extensive land reclamation south and west of the inner harbour. A dry dock of 14,000 tons lifting capacity is sufficient for the largest ships at present trading with Java. The first extension, consisting of a quay wall 8,300 ft. long, was found quite insufficient, and an additional wall 1,400 ft. long, suitable for ships of 33 ft. draught, was built on the west side of the harbour basin, and later extended 1,600 ft., thus covering the whole western shore. Further extensions of the harbour can only be made in soft ground 60 to 65 ft. deep. The quays will rest on the bed of a 164 ft. wide channel dredged until firm ground is reached, and filled with sand to well above high water. Walls consisting of reinforced concrete caissons will then be floated into position, sunk through the sand to the firm ground, filled in with concrete, and finished off with a low wall projecting 3 ft. 3 in. above ordinary high-water level. The roadstead is one of the best in the Netherlands Indies, and approximately 3,000,000 register tons of cargo are dealt with annually.

THE UNIFLOW STEAM ENGINE.

The trend of industrial development in the Far East, particularly with regard to the textile industry, the generation of electrical power and other industries where, as a rule, ample condensing water is available and where the direction of rotation of the prime mover installed is constant and continuous, offers an important field for the employment of the Uniflow steam engine. Because of its reduced heat losses to cylinder walls and to condenser the Uniflow represents the most highly efficient type of the modern reciprocating steam engine. Its advantages, which are obtained not only in very large engines but extend down to the smallest sizes, are perhaps insufficiently appreciated in industrial circles, and therefore very real value attaches to a paper on the matter by Mr. F. B. Perry, recently read before the Institution of Mechanical Engineers at Lincoln.

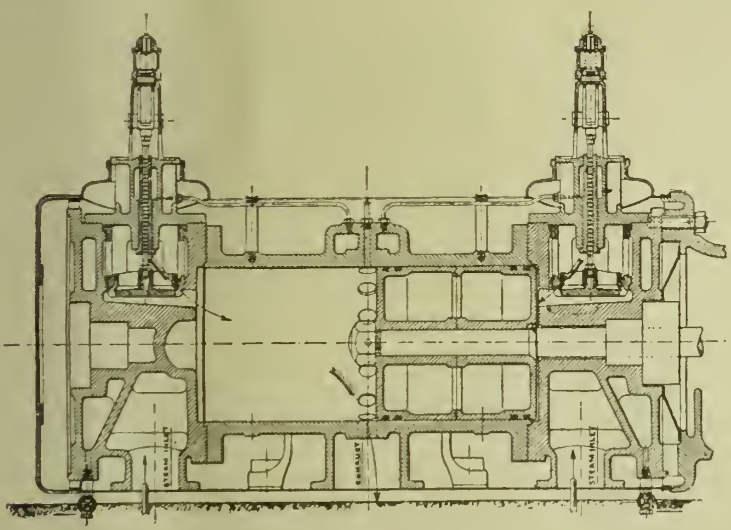


Fig. 1.—The Uniflow Steam Engine. Detail of Cylinder.

In his opening remarks the author pointed out that the Uniflow engine was invented in England in 1885 by T. J Todd. In 1908 a valve gear was devised suitable to the engine, and manufacture was commenced on the Continent and in Great Britain. The principle, as its name implies, is "one flow" for the steam, that is, from the hot inlet end to the cool exhaust at the centre. The cylinder is made long enough to accommodate a piston which has a total length nearly equal to the stroke of the piston, usually 10 per cent. less. The cylinder barrel is prepared with exhaust ports at about the centre of the length of the barrel. By this arrangement the necessity for exhaust valves disappears, as the piston just before the end of its stroke in either direction uncovers the barrel slots which lead to the condenser. Consequently a free and ample opening is provided for the exit of steam and for reduction of pressure in the cylinder to the condenser pressure. This description will be understood on reference to Fig. 1.

The length of the exhaust ports is usually 10 per cent., and the length of the piston 90 per cent., of the stroke. The clearance volume, owing to the absence of exhaust valves and chambers to contain them, can easily be reduced to about 2 per cent. of the piston's displacement. The compression ratio is therefore about 1 : 46. Under these conditions a good vacuum is necessary to prevent an excessive rise in the compression pressure. To obtain this, the condenser is usually placed immediately below the cylinder, and the exhaust ports, practically unlimited in area by structural considerations, are made large enough to offer only a negligible resistance to the passage of the steam. Relief valves are provided in case the compression pressure should increase excessively through leakage past the admission valves or a fall in the vacuum. In some cases a feed-water heater is interposed between the cylinder and the condenser.

In cases where it is necessary to change over from condensing to non-condensing, it has been usual to provide an additional clearance space in each cylinder-cover communicating with the cylinder through a valve which is closed when working condensing. This provision, however, is only suitable for temporary non-condensing working, as the enlarged clearance space and surface are inimical to economy. The best Uniflow engines are now fitted with an arrangement by which they can work economically non-condensing, as the same small clearance space and surface is maintained whether working condensing or non-condensing.

Another peculiarity of the Uniflow engine is the early cut-off required to obtain a high ratio of expansion in a single cylinder, and a powerful and highly sensitive governor is necessary to control the positive valve-gear needed.

ADVANTAGES OF THE UNIFLOW ENGINE.

(1) *Economy.*—The results of tests for steam consumption show that, with 180 lbs. boiler pressure and 200 deg. F. superheat, consumption of 10.5 lbs. and 10 lbs. per i.h.p.-hour can be obtained at full load from engines developing 500 i.h.p. and 1,500 i.h.p. respectively. These low rates of consumption are due mainly to reduction of cylinder condensation resulting from the high temperature of the cylinder ends, the position of the exhaust ports, the reduction of clearance surface and volume, and the high compression. The temperature of the cylinder metal varies from point to point along the bore. Readings taken from a cylinder close to the inside surfaces of the cover and barrel have given the following temperatures:—Cover, 400 deg. F.; barrel, half-way between cover and exhaust ports, 250 deg. F.; at middle near exhaust ports, 160 deg. F. So marked is this temperature gradient that, to prevent trouble in working, it is necessary to bore "uni-

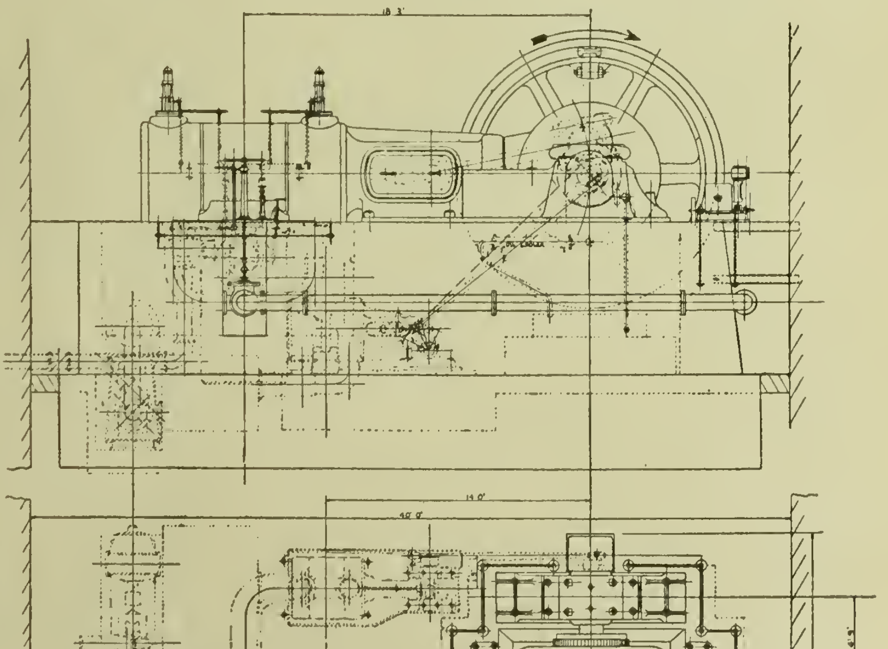


Fig. 2.—Details of Design of 1,100 i.h.p. Uniflow Engine by Messrs. Robey & Co., Ltd., of Lincoln, with Generator.

flow" cylinders barrel-shaped when cold, that is, larger in diameter at the middle than at the ends. The barrel temperatures vary very little when working either with saturated or superheated steam, due to the early cut-off, thus making this type of engine particularly suitable for superheated steam.

(2) *Flexibility.*—The steam consumption per b.h.p.-hour at full load is low, owing to the small number of glands and working parts absorbing power in overcoming friction, nor does it increase appreciably with reduction or increase of load.

(3) *Speed Control.*—It is claimed that the Uniflow engine is specially adapted to give steady turning under either uniform or fluctuating loads, first because the indicator diagrams when corrected by the forces required to accelerate and retard the heavy reciprocating parts show a fairly uniform effective pressure on the crank-pin, and secondly because the whole of the power is developed in one cylinder, so that any change in the position of the governor produces its full effect in a single stroke.

(4) *Upkeep.*—Compared with a multi-cylinder compound engine, which is its nearest equivalent for economy, the cost of upkeep, oil and stores will be greatly reduced owing to the extreme simplicity of this engine and the small number of working parts.

(5) *Floor Space and Foundations.*—The flood space occupied by the Uniflow engine is less than that required by the tandem (or any other multi-cylinder) horizontal compound engine. The foundations will also be smaller and less costly than for a compound engine.

DETAILS OF DESIGN.

The 1,100-i.h.p. engine illustrated in Fig. 2, page 333, was built by Mr. Perry's firm—Messrs. Robey & Co., Ltd., of Lincoln. It drives a generator at a speed of 120 r.p.m., with an overhead capacity of 25 per cent. for two hours and of 50 per cent. for a few minutes. The steam pressure is 200 lbs. per sq. in. and the superheat 200 deg. F. The cylinder, 35 in. diameter by 40-in. stroke, consists, as shown by Fig. 1, of a barrel, a plain casting, carrying only the exhaust belt and two small brackets for bolting to the base-plates, and of two end covers containing the steam valves. These last are double-beat of large diameter and small lift, the upper part being movable relatively to the lower, so that the distance between the two valve faces can always adjust itself to the distance between the faces of the seats when the latter varies under changes of temperature. The course of the steam through the covers, steam valves, cylinder, and exhaust valves is indicated clearly by the arrow in the figure. In the bottom of the cover is a small passage leading to a relief and drain valve, and in the latest engines to a small valve, which opens automatically when working non-condensing to by-pass steam to the exhaust and keep the compression at a pre-determined limit. The admission valves are raised by cams and rollers operated from eccentrics on a valve shaft. This shaft also carries a powerful combined centrifugal and inertia governor which, by suitable mechanism, turns the eccentrics through small angles and thus regulates the point of cut-off. A small hand-wheel on the end of the valve shaft permits the engine speed to be varied 5 per cent. up or down while running.

The condenser is usually placed immediately under the cylinder, and the air-pump, also on the uniflow principle, is driven through a rocking-shaft from a small crank at the idle end of the crank-shaft. On the engine illustrated an oil extractor is placed between the cylinder and condenser to prevent oil reaching the cooling tower.

The engine last described, like most Uniflow engines, runs at a fairly fast and constant speed of revolution, but there are cases in which slow and very variable speeds are needed. In such cases the engines are often of large size, and the designs for the cylinders, heavy pistons, valve gears and governors require very careful consideration and modification. An engine recently built by Messrs. Galloways, Ltd., of Manchester, for driving sheet mills at a steel works in South Wales is a case in point. This engine is believed to be the largest Uniflow engine in the world. It is coupled directly to the mills and runs at 28 r.p.m. The steam pressure is 160 to 180 lbs. per sq. in. and the superheat 150 deg. F. The cylinder, 60 in. diameter and 6 ft. stroke, consists of a middle piece containing the exhaust ports and passage, two short tubes forming the cylinder barrel and two ends containing the steam-admission valves. The two barrel pieces are connected to each other by bolts passing through the exhaust belt and relieving the latter from longitudinal stress. An inspection door is provided to give access to the cylinder without removing the cylinder end or piston. A safety-valve, actuated by a cam gear, is fitted to each end of the cylinder to control the compression pressure by opening automatically whenever the vacuum falls. When starting the engine, the valve is open and operates till it closes automatically when the vacuum is formed. The admission valves are of cast iron, double-beat, so constructed as to remain tight under all temperatures. Each valve is driven by an eccentric carried on a valve shaft, the cut-off being determined by the position of a sliding block in a vibrating link. A centrifugal governor, acting through a floating lever device, and controlling the small balanced piston valve of an oil-pressure servo-motor cylinder, determines the position of the block. The crank-shaft is carried on two bearings, and the crank is overhung. The fly-wheel, carried between the crank-shaft bearings, is 32 ft. diameter, and weighs 160 tons.

The "Blackstone" Tractor described in the last issue of this Journal. The Tractor is convertible from a track or wheel machine to the other type. The 25 b.h.p. three-cylinder engine starts instantly on paraffin without petrol or lamp and is reversible for driving machinery in either direction with an open belt. It is fitted with adjustable governor, which controls the speed of the engine when ploughing or driving machinery. The Tractor is manufactured by Messrs. Blackstone & Co., Ltd., of Stamford, one of the firms associated with Agricultural & General Engineers, Ltd., of London.

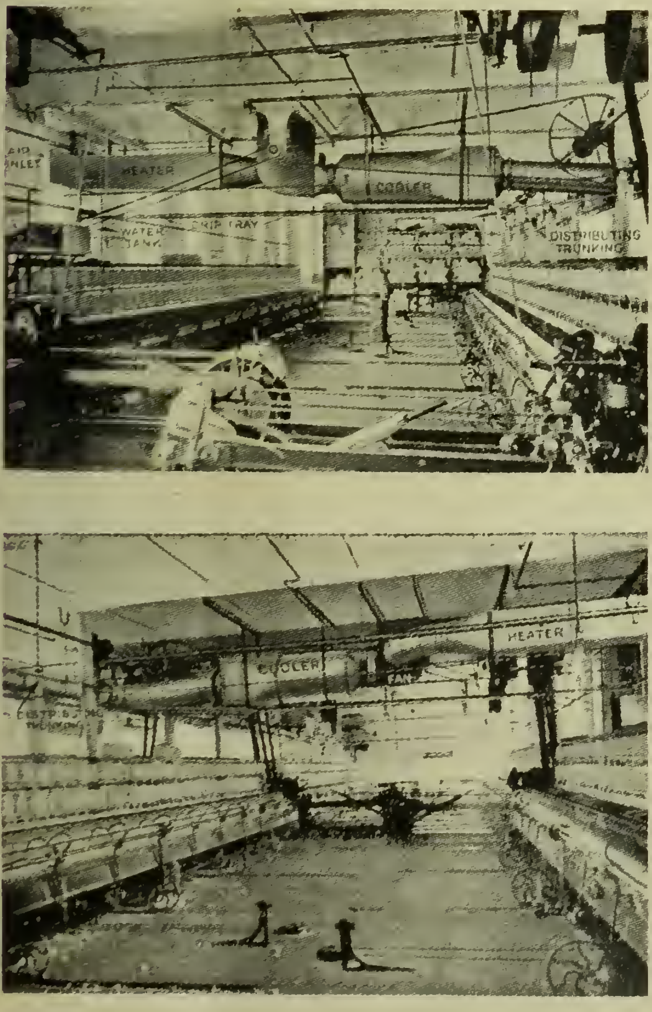
HUMIDIFYING AND VENTILATING PLANT.

The nature of the industries connected with the Far East cause special interest to attach to modern machinery for dust collection and separating plants and for the purposes of heating, ventilation and humidification and the creation of artificial atmospheres such as are essential in textile works. On several occasions plant of this description by well-known British makers has been described in these pages, and the particulars given on the present occasion deal with the Cyclone system of humidification and ventilation by Messrs. Matthews & Yates, Ltd., of Swinton, Manchester.

The right-hand illustration shows a typical installation by the firm for humidifying, heating and cooling in a weaving shed.

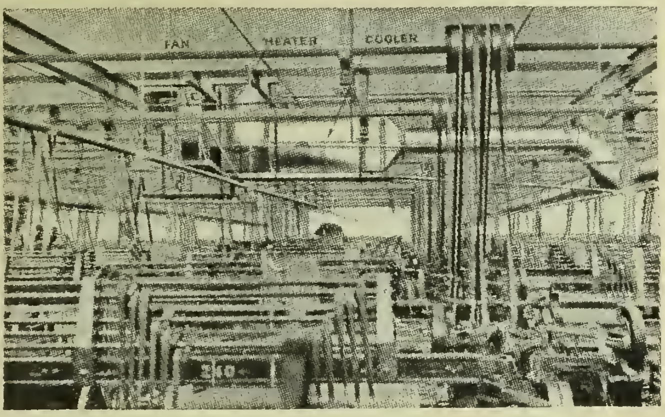
Views are also given of similar plant installed in mule-spinning room.

The plant essentially consists of inlet pipe containing the spiral heating coil, so arranged that all the in-coming air comes into direct contact with the hot surfaces. The blower that draws in the fresh-air supply is fixed with the suction side immediately below the inlet pipe, its delivery mouth being attached to the cooling apparatus, which latter consists of a chamber wherein are fixed a number of cyclone patent water sprayers; these sprayers break the water up into a perfect mist; the air passing through this chamber is by this means brought to the desired temperature, the surplus water is caught by a set of eliminator plates, fixed at the opposite end of the chamber, and drained away. Steam jets are also fitted inside the distributing ducts at the point of division arranged to blow in both directions along the said ducts. The distributing pipes are provided with holes at intervals of about 12 ft.; these holes are on the top side of the pipe, and are fitted with sliding doors to allow of occasional cleaning. At shorter intervals, and on alternate sides of the pipes, holes are provided for delivering the fresh air, humidity, etc. The condensation of moisture and the drain from the heating coils is taken care of by connections at end of pipe lines and waste pipes to the nearest drain. Drip trays are also provided under all trunking and apparatus to prevent the moisture from condensation from dropping on to the machinery below.



Two views of the "Cyclone" Humidifying, Heating, and Cooling System in a Mule-Spinning Room. Top view shows the driving side, with Water Re-circulating Pump, etc.

The plant is applicable to a wide range of requirements, the greatest point of variation being the place of inlet.



"Cyclone" Humidifying, Heating, and Cooling Apparatus in Weaving Shed.

In the weaving shed the air is usually drawn in from the roof, whilst in the spinning room the intake is usually through a window or side wall. The system has been satisfactorily applied to the fermenting room of a brewery, where it is essential that the carbonic acid gas from the vats should be swept out of the room and a low temperature maintained during the summer months. In the past attempts have been made to provide a low temperature by means of refrigerating plants, but the initial cost of such plants is high, as is also the running costs, and the results obtained have not been so satisfactory, due to the lack of ventilation, which is a feature of the Cyclone system.

Special advantages attach to the Cyclone system, inasmuch as it is independent of the motive power system in the shed or room in which it is installed, and can, therefore, be put into operation any time prior to the mill starting-time; the necessary and correct working atmosphere and temperature is therefore obtained by the time the operatives commence work. The cooling, heating, humidifying and blowing unit is always fixed in a central position, the distributing pipes radiating from the centre; this ensures more even conditions than does end distribution, and by means of the perfect individual control of the necessary elements an even temperature or atmosphere is obtainable under the most unequal conditions. By reason of the large volumes of fresh air drawn into buildings under treatment, the entire air may be changed any number of times per hour according to the number of operatives in the building. As the name of the system implies, the air is blown into the building under pressure, thus creating a plenum or fullness inside which drives out all foul air created by the human aspiratory and manufacturing processes; this is a very important point, and the strongest possible recommendation for this system will be found in the results of official tests for carbon dioxide gas. With this system the air is conditioned inside the apparatus, and there is, therefore, no water spray to drop about on to the machinery below, as is the case with some systems. In the hot summer months the temperature is kept low by reason of the volumes of washed and cooled air passed through the apparatus. This system will heat, cool, humidify, and ventilate, and each particular feature is under individual control.

Under this system the blower may be the belt-driven type, or direct coupled to one of Messrs. Matthews & Yates's standard protected type motors. Whichever type is used the installation is, as already explained, independent of the main drive. In the former type the drive is effected by belt from the line or other shafting; here, again, the installation can be started before the mill starts, as when the steam jets are opened they will create sufficient air current to effectively humidify and warm the atmosphere, and therefore, in both cases, work can proceed under the required conditions immediately a start is made.

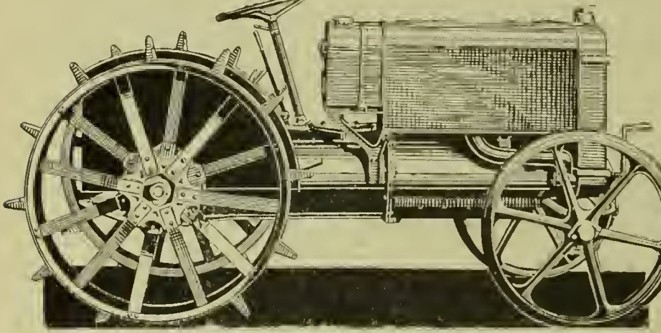
Col. Sir Charles Allen, chairman of Henry Bessemer & Co., Ltd., and of the Ebbw Vale Steel, Iron and Coal Co., Ltd., left £98,593 gross and £87,855 net.

THE AUSTIN MOTOR COMPANY'S AGRICULTURAL TRACTORS AND AUTOMATIC GENERATING SETS.

Fuller particulars are now given of the Austin agricultural tractor mentioned in our last issue in connection with exhibits displayed at the Royal Agricultural Show by the makers, the Austin Motor Co., Ltd., of Northfield, Birmingham.

Such a strong case has been made for the tractor system of ploughing during recent years, and the agricultural tractor is making such steady headway in the Far East, that it is hardly necessary here to deal with its advantages over other methods. The economies the tractor system permits both in initial cost and running charges are, of course, greatly in its favour; it will deal with equal facility with fields of small or large dimensions and of regular or irregular shape, and whether level or undulating. It has been truly said that it can go everywhere where ploughing is possible, and is readily adaptable to a variety of conditions. These facts render the tractor especially applicable to Far Eastern conditions, where it has so far mostly been employed in intricate work, for ploughing between standing crops and on ground of irregular shape.

The Austin tractor is capable of ploughing three 10-in. furrows, 6 ins. deep, in practically any average soil. The machine has won a wide reputation. During 1920 it has so far secured, amongst other successes, the first prize in the first tractor trials ever held in India. In the same year it has also won the chief award for new implements at the Royal Dublin Society's Show, and also the silver medal given at the show of the Staffordshire County Agricultural Society for the best new farm implement. King George has just purchased an Austin tractor for use on the Royal estates in Scotland. During 1919, moreover, the machine secured the highest awards at the most important agricultural exhibitions.


The Austin Motor Company's 28 cwt. Agricultural Tractor.

The tractor is notable for a very strong trunk chassis and back-axle casing, which enclose all the gears. It has a four-cylinder engine of 25 h.p. with detachable head, and automatically lubricated. The cylinders are each of 3¾-in. bore by 5-in. stroke. After being started up on petrol, the engine runs on paraffin, which is carried in a 10-gallon tank. The fuel is heated by the exhaust pipe, and the mixture in the carburetter is completed with air which has passed through a cleanser. Ignition is by high-tension magneto, and cooling on the thermo-syphon system. A centrifugal governor controls the engine speed at 1,500 revolutions per minute with the throttle open. A steel cone clutch with detachable Ferodo segments transmits power by bevel gearing to the first motion cross-shaft, thence through the gear-box to a large spur wheel containing the differential gear on the back axle. Forward speeds are 2½ and 4¼ m.p.h., and the machine has a reverse speed of 2 m.p.h. Corresponding gear ratios between engine and road wheels are 60.8 to 1, 33 to 1, and 78.2 to 1. All gears are of forged steel and run in oil; their shafts are carried in roller bearings. Control of the machine is very simple, consisting of a throttle lever just in front of the steering wheel, clutch pedal, gear changing lever, and two brake levers operating directly on the rear wheels. An ingenious feature of the machine is the pivoting of the front axle in such a manner as to give it the fullest freedom of movement when the machine is passing over uneven ground. As the chassis is carried on this single pivot at the front a true three-point suspension is provided, and all risk of distortion removed.

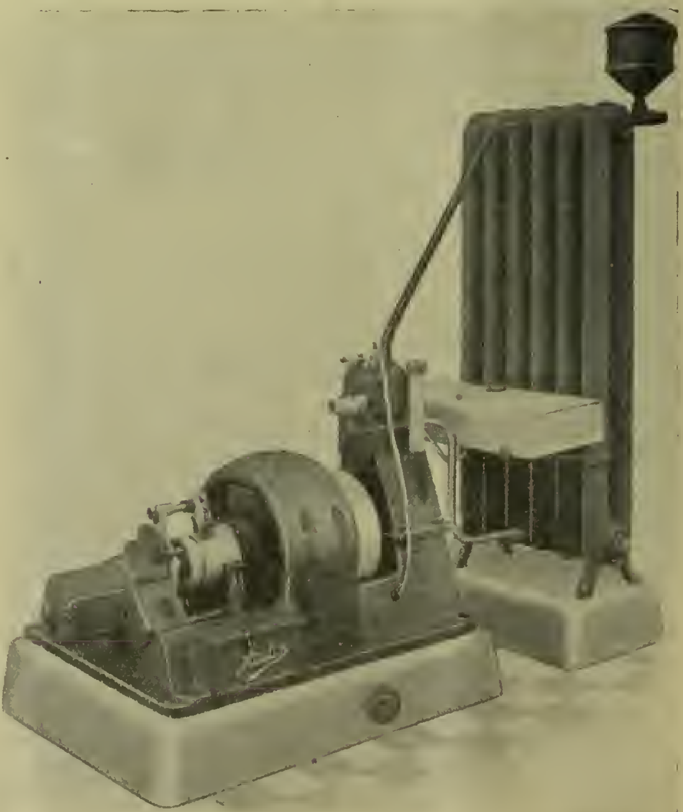
The tractor weighs about 28 cwt. ready for work. The question of weight is an important one. The Austin Co. consider that they have hit the happy medium in putting a comparatively light tractor on the market.

On low gear it will give a sustained pull of 2,500 lb. at the draw bar. As to its capabilities, it will plough 5 or 6 acres a day of average land, even when handled by an unskilled person. It is capable of cutting and binding 6 acres in 2½ hours, and will thresh continuously with a consumption of 1½ gal. of paraffin per hour. On the road it will haul a load of 4 tons up a gradient of 1 in 12. On the field, in the farmyard, and on the road alike it will give good service with widely different implements.

AUSTIN AUTOMATIC GENERATING SETS.

The small electric generating sets manufactured by the Austin Company, from .75 to 12 kw., mentioned in the last issue of this Journal, are now illustrated. The wide market existing for this class of plant in the Far East and the extensive field of usefulness it fills are too well known to require emphasising on this occasion. The Austin autoplant can be left to run for a long period without any attention except the provision of fuel, for it is entirely automatic in its operation. When the demand upon the battery exceeds a pre-determined limit, the engine is automatically started and kept running till re-charging is completed. The engine can be run on petrol, benzol or town's gas, or the plant can be adapted for use with water power. To electrical engineers the plant commends itself, not only by the arrangements by which the engine is started and stopped, but the ingenious provision for correctly regulating the voltage for charging without interfering in any way with the voltage of the output. This regulation also prevents the lamps being overrun, thereby considerably increasing their life, as it does that of the battery.

A storage battery of ample capacity is supplied with the


The Austin .75 kw. Autoplant.

Austin sets. A complete plant consists of engine, bedplate, water cooling tank or radiator, fuel tank, water, exhaust, and fuel piping up to 10 ft., foundation bolts and silencer, specially compound wound dynamo and automatic controller and automatic fuel tap. The controller is of the switchboard pattern, comprising enamelled slate panel with full range of instruments. The battery comprises glass containing boxes, positive and negative sections, acid separators, spray plates, insulators, and non-corrosive connecting bolts and hydrometer.

RAILLESS ELECTRIC TRACTION.

Although railless electric vehicles cannot be said to have proved a success in Great Britain, where their installation has made but little headway, important possibilities still attach to the system when employed under suitable conditions. This is particularly the case in foreign countries, and in the Far East especially perhaps. In any case, the Far East has a good deal to learn from the experience of the system gained in Great Britain, and evidence of this is found in an interim report of the Departmental Committee on Road Vehicles recently issued, the recommendations of which are well worth study.

The imposition in England of a weight restriction of 5 tons loaded has acted against improved design, and hitherto the vehicles have been constructed of materials too light to withstand heavy service, a circumstance which has led to frequent breakdown and consequent increases in working expenses. This weight restriction has now been amended to 5 tons unloaded, and this will lead to more satisfactory construction.

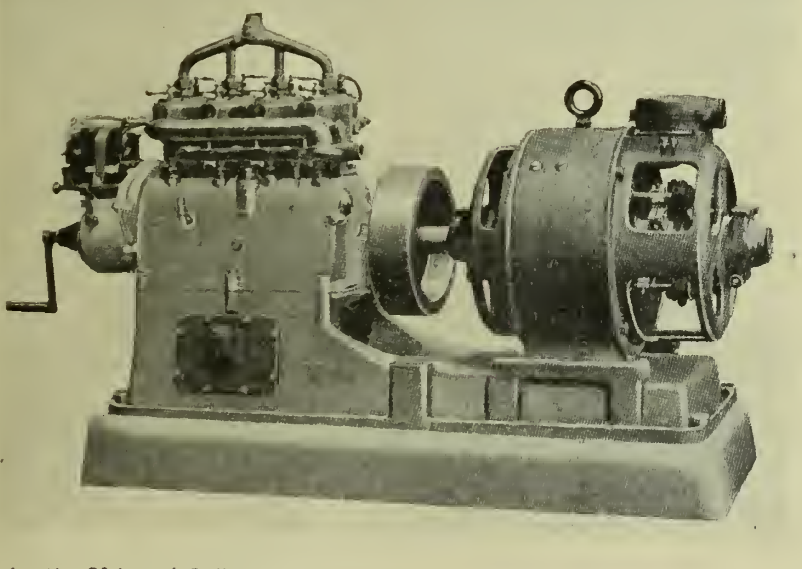
In its financial recommendations the interim report suggests a fixed annual charge for road adaptation and maintenance based on the seating capacity of the vehicle. In connection with the working expenses of the railless car in comparison with the track vehicle, the former, although not of the most satisfactory construction, are approximately 4d. per mile cheaper in operation than the ordinary tramcar. This is chiefly due to their smaller weight and their running on more level roads. In arriving at the cost of working the railless vehicles, in the investigations under consideration every possible charge was included, and all renewals were paid out of revenue. It is found, however, that as the traffic density and mileage increase the difference between the working expenses of the two systems becomes less marked, and finally the railless car shows a greater charge than the tramcar. It is, therefore, of advantage to ascertain the point at which this takes place. The initial cost of a service will, however, be a most important factor in new undertakings. From figures prepared, the cost of construction of one mile of tramway route is £29,000 single line, or £54,000 double line, as compared with £4,500 for a mile of overhead equipment necessary for the operation of railless cars. It is calculated that the point at which a tramway becomes more economical in operation than a railless system is reached, in the case of a single line, at a five minutes' service, with an annual mileage of 160,000; and as regards a double track, at a three minutes' service, with an annual mileage of 266,000. In computing these figures due allowance has been made for the smaller earning capacity of the railless car on account of less seating accommodation.

The carrying capacities of the tramway and railless vehicles have been taken as 60 and 51 respectively a difference of 15 per cent. less in the case of the latter type. This difference, however, would only hold good at busy times, when all cars were full, and this would occur for about 15 per cent. of the time the cars were in service. Thus, with a fare of 1d. per mile, the decreased earnings in the case of the railless vehicle would be, taking a daily mileage of 120, 15 per cent. of 120 miles at 9d., or 15s. 6d. per day, or 1.35d. per car-mile over the total mileage. The question of cost, although from the undertakers' point of view the most important is, nevertheless, not the only consideration. Most important, from the viewpoint of the passenger, is the question of comfort in travelling. The reply in general is that the tramway, provided the track is in good condition, is the better in this respect.

Another consideration is safety, and in this respect it is thought that railless cars are liable to skid on snow, and, not having a defined track, are more likely to collide with other traffic in foggy weather. On the other hand, railless vehicles have several advantages not possessed by the track vehicles. The breakdown of a car does not affect other parts of the service as in the case of a tramcar. Cars may be drawn up closer to the sidewalks for loading and unloading; this feature is important in congested thoroughfares. Railless vehicles make considerably less noise in operation, and offer greater facilities for inter-running. In addition to these points in their favour, railless vehicles may be employed beyond the limits of the trolley wires by the installation of batteries. This has been done for the past few months in England on the Leeds-Bradford parcels service at a running cost of 18.7d. per car-mile, or, with the addition of interest and sinking fund charges, 22.5d., or 7s. 6d. per hour. Had two trips per day been run for a longer period the cost per mile would have been reduced. As an actual example of the parallel running of the two systems the following statistics of the Bradford Tramways Department for the period April 1, 1919, to March 2, 1920, are interesting :—

On the tramways the total running cost, including charges of all natures, for a mileage of 4,807,328, was £464,872, an average of 23.207d. per car-mile. The total revenue amounted to £518,558, or 25.888d. per car-mile, giving a profit per car-mile of 2.680d. In the case of the railless vehicles the total mileage was 350,221, and inclusive running cost £26,432—18.051d. per car-mile. The revenue was £17,010, or 11.656d. per car-mile, resulting in a loss of 6.395d. per car-mile. A considerable reduction in the power costs is noticeable in the case of the railless vehicles, the figure being 1.749d. per car-mile, as compared with 3.254d. for the tramcars.

The report as a whole indicates that much brighter prospects are before the system of railless electric traction, whether employed as a separate and independent installation or as an adjunct to main track systems.


Austin 6¾-h.p. 4-Cylinder Engine and Dynamo for Automatic Electric Generating Set described on preceding page.

AMERICA'S RUBBER INDUSTRY.

As is generally known, America is Great Britain's best customer for rubber. Recently much of the rubber supplied the States has been sent direct from British possessions instead of through London. Recent statistics supplied by the American Ruober Association show that for the twelve months ended 1917 America used 306,113,652 lb. of crude rubber and 246,500,000 lb. during the first nine months of 1918. The sales value of the total production of the rubber industry in the States advanced from $895,816,000 in 1917 to $1,122,000,000 in 1918. It is estimated that by the end of 1920 some 51,000,000 tyres for motor vehicles and cycles, using about 180,000 tons of rubber, will be required. The total world production of crude rubber is put at 300,000 tons, of which the United States takes about 70 per cent., drawing 80 per cent. of her aggregate requirements from the British Empire. In these circumstances, the endeavours recently noted on the part of the States to greatly increase her acreage under rubber are well justified. America is making extensive preparation to increase her exports of rubber goods, and her increased exports of tyres to the United Kingdom is a matter for general comment.

MODERN ENGINEERING PRACTICE.

OIL AND COLLOIDAL FUELS.

The use of oil fuel continues to make steady progress in engineering circles, some of the largest Atlantic liners now employing oil fuel instead of coal. In one instance, that of the *Aquitania*, so great is the saving of labour that the staff formerly required for stoking has been reduced from 320 with coal firing to 12 with oil fuel, 12 oil fires being allotted to each man, and the reduced staff has a far pleasanter time in the stokehold than their predecessors. Important experiments with oil fuel are being made on English railways. So far the experiments have proved conclusively that the generation of steam is far steadier and more uniform with oil than with coal, the head of steam being more easily maintained. Comparative tests have also been carried out with engines fitted for the use of ordinary coal fuel, pulverised fuel and colloidal mixture, consisting of 60 per cent. of pulverised coal and 40 per cent. of oil. Special equipment was fitted for the last-named fuel. It is understood that the results obtained were quite satisfactory and fully warrant the continuance of experimental work in this connection. Whilst coal is still the most abundant and, under normal conditions, the cheapest source of fuel for transport purposes, it should be remembered that the oil used as fuel for steam raising is unsuitable for refining; much of it, indeed, is the residue after distillation, and apart from its value as fuel it is largely a drug on the market.

AN IMPROVED TYPE OF INSULATOR.

Messrs. Thomas de la Rue and Co., Ltd., of London, forward us particulars of their "Telenduron" moulded insulators for telegraph and telephone lines, the use of which should mark a substantial improvement on present practice of installing insulators of glazed porcelain. In the new insulators the constituents are twice pressed under hydraulic pressures up to 250 tons in conjunction with hardened steel moulds, heated to an accurately controlled temperature. They have been submitted to exhaustive electrical and mechanical tests, the results of which justify the manufacturers claiming for Telenduron product a marked superiority over porcelain with its excessive brittleness, absorption of moisture due to incomplete vitrification or porosity of the material and uncertain efficiency in actual service. With the new insulators high-voltage tests under wet conditions give practically equal results to the same tests conducted under dry conditions. Excellent results are obtained for insulation resistance under a temperature of 100 deg. centigrade, the insulator completely recovering after cooling. Complete recovery is also noted after immersion in boiling water. Dropped from a height of 10 feet on to a wood block floor the specimens were undamaged, and showed only a slight chipping when dropped on to a concrete floor. Compression tests showed a very large factor of safety. The material is unaffected by acids, it is non-hygroscopic, and is produced with a surface finish which tends to globulise moisture and so destroy the conducting film which forms on porcelain. It is a moulded material and is adapted for a great variety of articles.

MODIFICATIONS IN SHIP DESIGN.

Investigations into the circumstances attending the damage or loss of merchant vessels by mine or torpedo during the war were initiated by the Board of Trade with the idea that the results might suggest modifications of design or practice or details that would conduce to greater safety of life at sea. Water-tight sub-division when well carried out proved efficient, and in large ships the maximum direct damage from mine or torpedo represents the maximum effect likely to be caused by a collision blow, and such vessels should survive. Distortion of the bulkheads, however, may follow explosion or blow of the collision and prevent or render inoperative the closing of the doors. Suction pipes, air escape pipes, or other channels of communication may be fractured in the damaged compartments, thus putting other spaces in communication with the sea and in modern practice non-return valves are fitted at the ends of such pipes. Provision is also now made for the installation of a screw-down non-return or similar valve to be worked from the bulkhead deck. Careful inspection is also urged during surveys to detect leaky bulkhead and tunnels. The structural strength of the bulkheads as constructed under modern regulations has proved sufficient. Investigations also show that, in vessels sub-divided transversely, if the integrity of all bulkheads, except those actually damaged, can be assured, the possibility of dangerous heeling developing is reduced to a minimum. Where a dangerous list has taken place it has done

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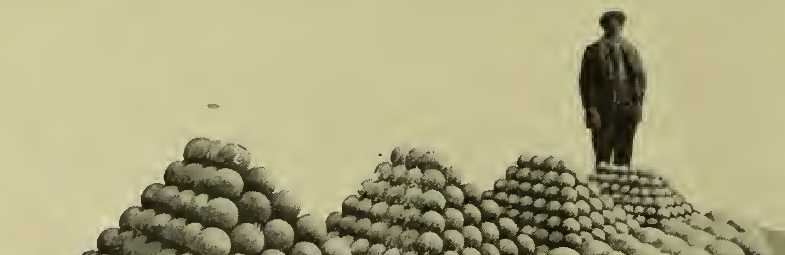

so in consequence of departments being flooded other than those necessarily opened to the sea.

RELATIVE ECONOMY OF OIL AND COAL.

Under modern practice the cost of generating power is, according to a simple American formula, approximately the same for oil and coal when the price of fuel oil in cents per gallon is one-half the cost in dollars of a 2,240 lb. ton of coal. It is assumed that the coal contains 14,300 B.Th.U. per lb., and that the heating value of the oil is 18,600 B.Th.U. per lb., and account is taken of the differences in labour in the two cases, which would be more favourable to the oil. Oil will undoubtedly be preferable to coal as a fuel where the power factor is low, provided that an adequate supply is available. Where the power factor is high, on the other hand, the use of coal is likely to be more economical. While fixed values cannot be readily assigned to such comparisons, a load factor of about 50 per cent. is apparently the dividing line above which coal will probably show an advantage and below which oil will probably be preferable from the economic point of view.

According to the records of three Pacific coast electric light and power companies, from 0.00653 to 0.02248 gallon of fuel oil per rated boiler horse-power hour is required to keep boilers fired in readiness to carry load. The lower figure is for a 1,000-h.p. plant and the higher one is for a 15,000-h.p. plant. The third plant with a boiler installation aggregating 12,000 h.p. consumed 0.02204 gallon of oil per boiler horse-power hour when the boilers were not carrying steam, but were idle. This expense is, of course, only a part of the cost of being ready to serve at any time. The total cost of this service is a considerable proportion of the company's operating expense. Items entering into the cost are interest on the investment, depreciation of apparatus, and the actual operating expense in the standby period which includes the fuel cost, labour, repairs and supplies.

ROLLED MANGANESE STEEL RAILS.

For many years cast manganese steel has been employed in tramway track work at points where the rails undergo excessive wear and tear, and for some time past rolled manganese steel rails have been used on railways where the use of castings is not advisable. The excessive hardness, ductility and resistance to wear of this metal are leading to its extended use in points, crossings and curves subject to very heavy traffic. In estimating the life of their manganese steel rails Messrs. Edgar Allen and Co., Ltd., of Sheffield, cite instances where on certain curves there are rails which have been in use for over ten years, and are still good for several more, whereas formerly ordinary steel rails of basic or acid open-hearth steel had to be renewed every twelve months or less. Again, there are points and crossings which have been in the track for seven to nine years and are still in good condition, where at one time when ordinary rails were used renewals had to be made every few months. One of the principal advantages of rolled manganese steel rails is that points and crossings can be built up to the railway company's standard design exactly as they are built up from ordinary steel rails. They are as flexible as any other part of the track; no shock takes place when fast trains pass over them; neither do the wooden sleepers sustain any damage. Should a point or crossing get damaged at any time, that particular part which sustains the damage can be replaced, without its being necessary to scrap any part of the remainder, which is unavoidable when cast manganese steel is used. The rails are so hard that it is practically impossible to cut them, and surplus metal is removed by grinding. Nevertheless they can be bent as easily as ordinary steel rails.

MODERN EXCAVATING PRACTICE.

The original steam navvy, which was capable of swinging or slewing its excavating gear through a little more than half a circle, has been now displaced to a large extent by the full-circle machine, commonly known as the steam-crane navvy. The size of machine most suitable for various workings is governed chiefly by—(*a*) The nature of the material, and (*b*) the output required per day. The former will determine the minimum cutting effort to be used. For example, 4 to 6 tons is suitable for material up to clay of medium hardness; 8 to 10 tons is suitable for stiff clay; 12 to 20 tons is suitable for boulder clay; 20 to 30 tons is suitable for heavier material, such as limestone and heavy iron ore. The output depends also upon the size of the bucket, which again is governed by the nature of the material to be excavated; thus a machine having 6 tons cutting effort is most efficient when fitted with a bucket of ¾ to 1 cub. yard capacity; if 12 tons, then the bucket should hold from 1½ to 2 cubic yards; and if 20 tons, from 2½ to 3½ cub. yards, to give approximate examples. An interesting modification is the combination of steam navvy and grab.

DAVID BROWN, Junr.

45, Hope Street, GLASGOW.

Acids: Acetic
  Benzoic
  Carbolic
  Cresylic
  Hydrochloric
  Sulphuric
Alum
Alum Sulphate
Ammonia (liquor and refined)
Asphalt
Basic Slag
Benzol
Bricks (Fireclay and Silica)

Caustic Potash
Caustic Soda
Coal Tar
Copper, Acetate
Copper, Iodide
Copper, Nitrate
Copper, Sulphate
Cresols
Dry Felt Fibre
Glucose
Glycerine
Hair (Manufactured)
Lubricating Greases
Molasses
Motor Spirit

Naphthas
Naphthalenes
Oils: Anthracene
  Blastfurnace Creosote
  Coal Tar Creosote
  Essential
  Fuel
  Fusel
  Fish
  Gas
  Green
  Lubricating
  Paraffin
  Petroleum

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Pitches
Red Lead
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Another useful development is a machine with an extended jib and bucket-arm to enable the excavated material to be discharged 60 ft. from the centre of the machine, as compared with 32 ft. standard practice. Or a normal length of jib may be employed, working in conjunction with a transporter. Advantages of short jib and transporter can now be combined in one machine. When the material is light and easy to dig, an endless-bucket type of excavator, feeding on to a belt-conveyor, forms a useful and efficient combination. Small machines of similar type to the larger installations are now available, and show satisfactory economies.

TRADE NOTES.

The Committee of the Netherlands Indies Fair has decided to hold next year an exhibition in Java of motor cars, motor lorries, tractors, tractor ploughs and motor cycles. Manufacturers of bicycles for the markets of the Dutch East Indies are advised "to finish such machines in all black, or at any rate to avoid a finish likely to rust easily, because of the trying climatic conditions. The rapid development of this market is evidenced by the fact that the importations of bicycles into Java and Madura increased from 2,466 in 1918 to 6,040 in 1919. Of the latter over one-third were of American make, while Japan's share of the trade had decreased from 1,428 in 1918 to only 150 in 1919.

Particulars have been issued of the offer by Vickers, Ltd., of £1,500,000 7 per cent. seven year notes to bearers at the price of 95 per cent. The notes are repayable at par on July 1, 1927. The company reserves the right to issue £2,500,000 further of similar notes. The company may redeem the issue at any time, wholly or in part, on three months' notice. The proceeds of the issue will be used for the extension of the company's business and its large electrical interests. The issue was fully subscribed. Messrs. Vickers wish us to mention that they have opened a depot for Wales and the south-west of England at 43, Park-street, Bristol.

The authorised capital of the Pacific Development Corporation has been increased from $10,000,000 to $25,000,000 in order to meet the demands of its growing business and to provide for several new enterprises in Shanghai, which include the Sun Cheong Ironworks, with a capital of $750,000 gold. Another enterprise is the recent purchase of land on the Shangpoo River front in the Yangtzepoo district to be used for docking and go-down facilities.

Mather & Platt, Ltd., the electrical engineers, of Manchester, pay an interim dividend of 3 per cent., free of tax, on the ordinary shares for the half-year ended June. It is intended to issue a further 210,000 ordinary shares of £1 each to existing holders this month. It is also probable that an issue of shares will be offered to the employees on favour-terms. Capital is required to meet the cost of extensions now in progress at the works.

Applications have been invited by the Brush Electrical Engineering Co., Ltd., of Loughborough, for 339,512 ordinary shares of £1 each at par, part of an authorised issue of 600,000 shares. The proceeds will be applied to pay for extensions of buildings and plant, to provide additional working capital, and towards the erection of houses for the accommodation of some of the company's work-people.

Thomas Robinson & Son, Ltd., manufacturers of flour milling and wook-working machinery, of Rochdale, have invited subscriptions for an issue at par of 125,000 7½ per cent. cumulative preference and 25,000 ordinary shares, all of £1 each.

The accounts of the Horseley Bridge & Engineering Co., Ltd., show:—Profit £24,452; brought forward, £210,606; dividend, 8 per cent., free of tax, for year, £11,804; expenses of shares issue, £5,649; income tax, £6,000; carried forward, £11,000.

J. Samuel White & Co., Ltd., of Cowes, Isle of Wight, announce an ordinary dividend of 15 per cent. (3s. per share), less tax, for half-year, making 20 per cent. for the year; in come tax, £43,945; carry forward, £103,628.

National Gas Engine Co., Ltd., of Ashton-under-Lyne, announce an interim dividend of 7½ per cent., less tax, on the ordinary shares for the half-year.

The directors of Babcock & Wilcox, Ltd., have declared a dividend of 9 per cent., free of tax, making 15 per cent. for year.

Brightside Foundry and Engineering Co., Ltd., of Sheffield, have declared a dividend of 10 per cent, free of tax.

The directors of the Birmingham Railway Carriage & Wagon Co., Ltd., recommend an interim ordinary dividend, 10 per cent. per annum, free of tax.

Gas Power without Coal.

Waste wood of all kinds, olive refuse, rice husks, tea prunings, coffee refuse, sunflower seed husks, cocoanut shells, sugar cane refuse, cotton seeds, fruit stones, and many other forms of vegetable refuse can be used with

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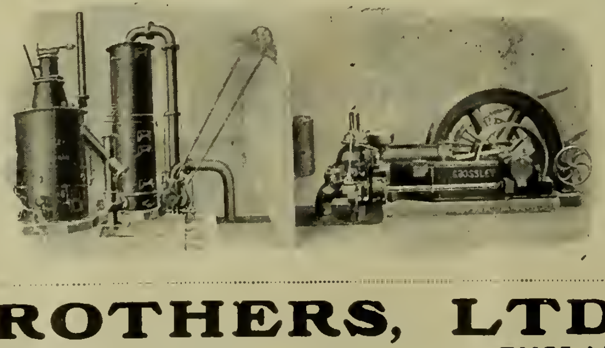

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Codes: A1, A.B.C. 4th and 5th Eds., Lieber's, Western, Engineering 2nd Ed., McNeil's (1908), Allis Chalmers', Bentley's Private.

Agents { CALCUTTA: Crossley Bros., Ltd., 5, Fancy Lane, Government Place. | MADRAS: Madras Engineering Company.
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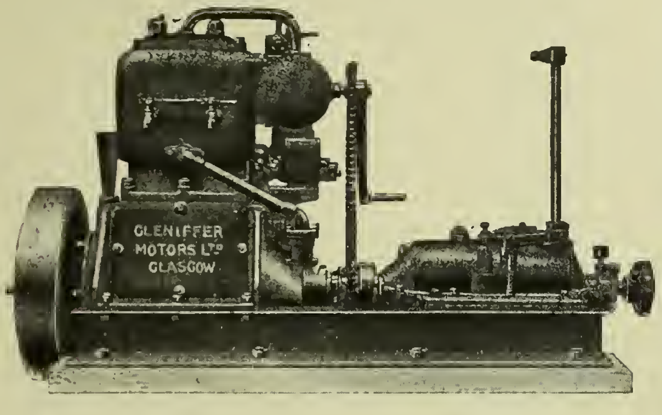

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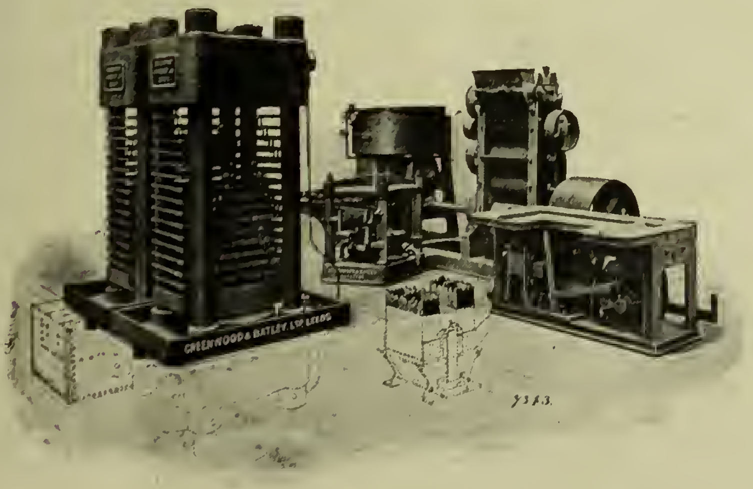

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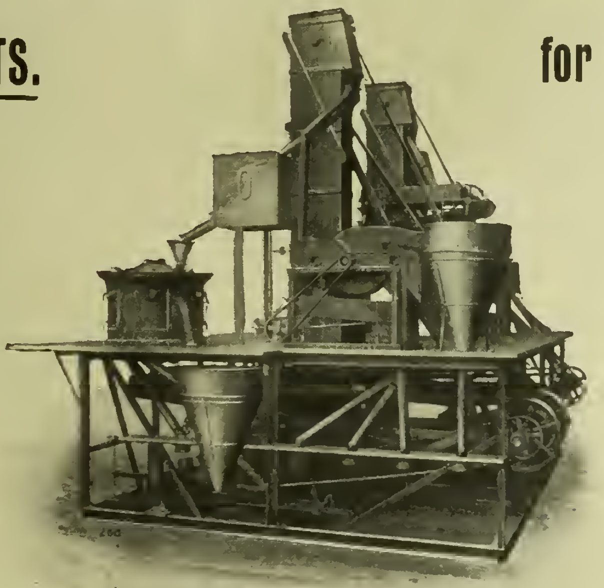

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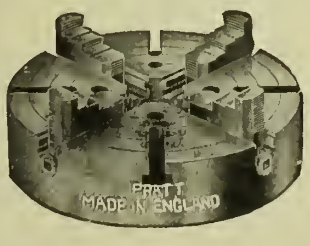

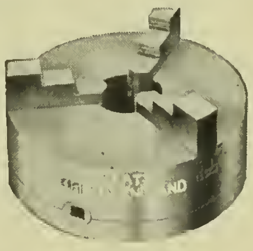

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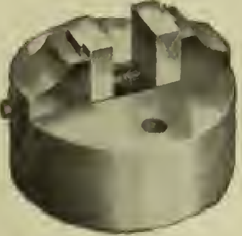

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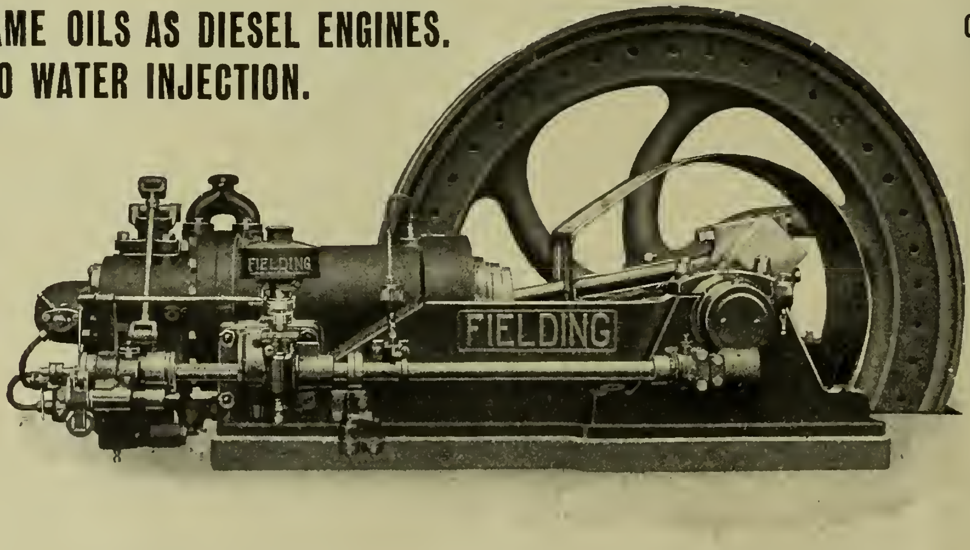

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Giving the names, addresses, and specialities of makers in the Chinese language.

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W. & T. AVERY, LTD., 51 Soho Foundry, Birmingham, England.	試器，秤量水，油，煤，穀之自動，稱及各種稱量器 51.	
THE BRITISH ALUMINIUM CO., LTD., 56 109, Queen Victoria Street, London, England.	亞摩溜謀製之片葉杆条及線繩等 亞摩溜謀為现世金類中之最輕者 56	
EVERSHED & VIGNOLES, LTD., 34 Acton Lane Works, Chiswick, London, England.	"電學儀器;"梅格""橋梅格"與"笪克頭"試驗全套,能量各種阻力. 34	愛弗夕與月格羅专有限公司倫敦
GLENFIELD & KENNEDY, LTD. 9 Kilmarnock, Scotland.	水機,汽機,氣機,及油機之各種活蓋; 自來水工程中之各種機件; 耿雷得冷水計表; 耿雷得熱水計表; 鴨希對各種專利吸水機; 各種水力機器及吸水機; 鴨希弗水閘及閘門之類; 計水平之計表及壓力表; 水機及汽機銅塞及活蓋. 9	格倫非尔與耿雷得有限公司 蘇格蘭
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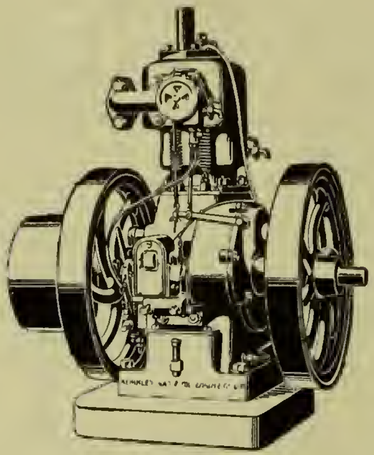

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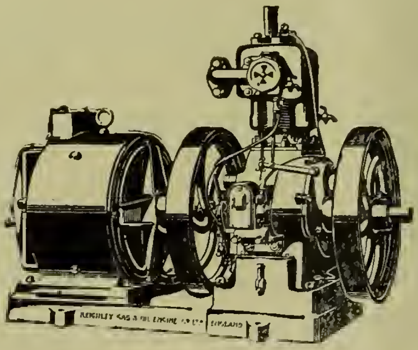

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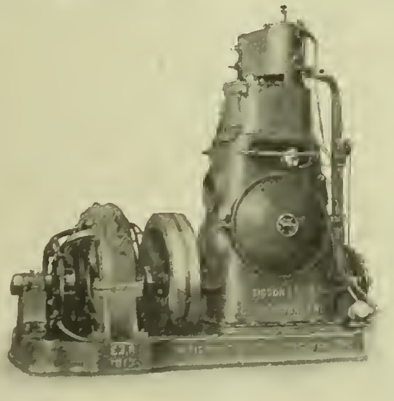

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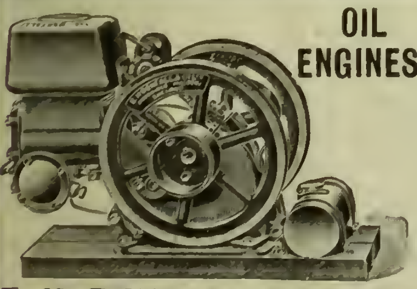

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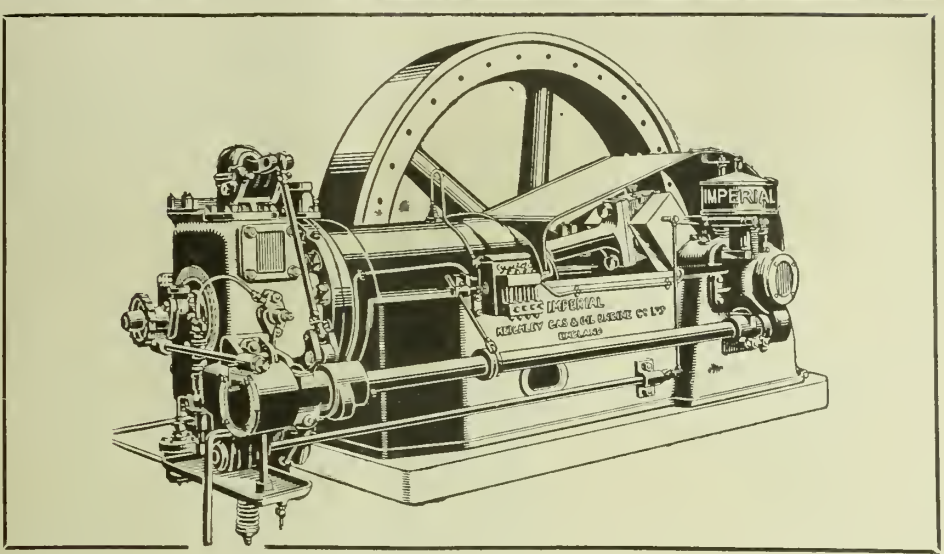
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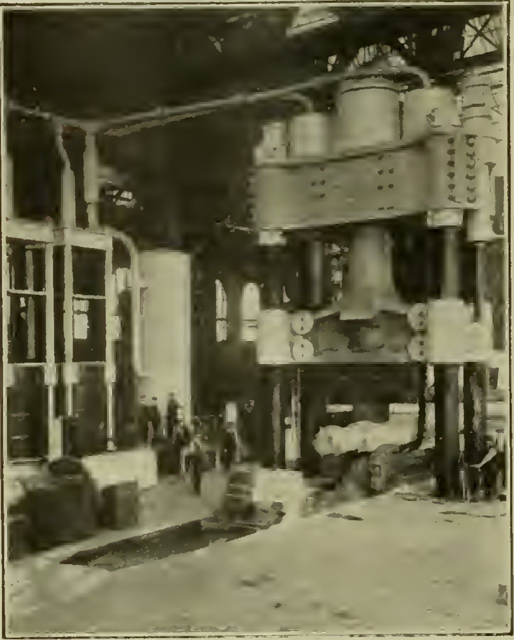

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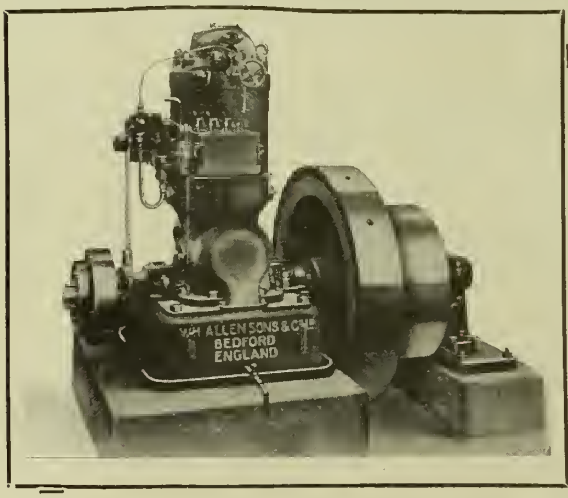

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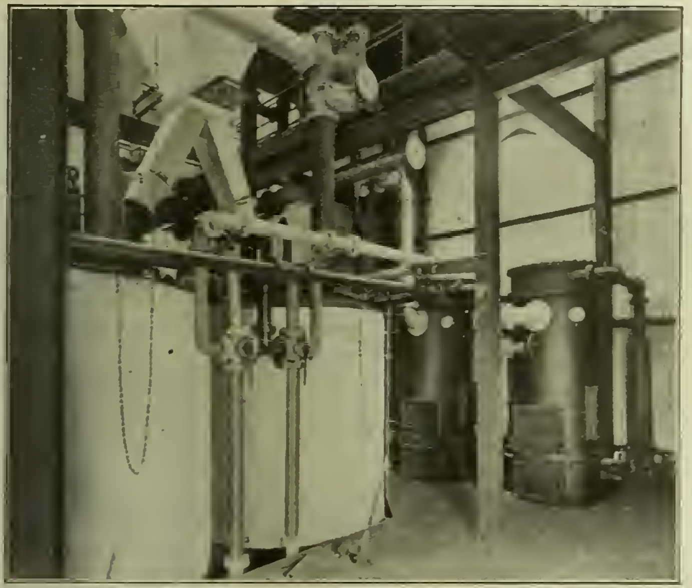

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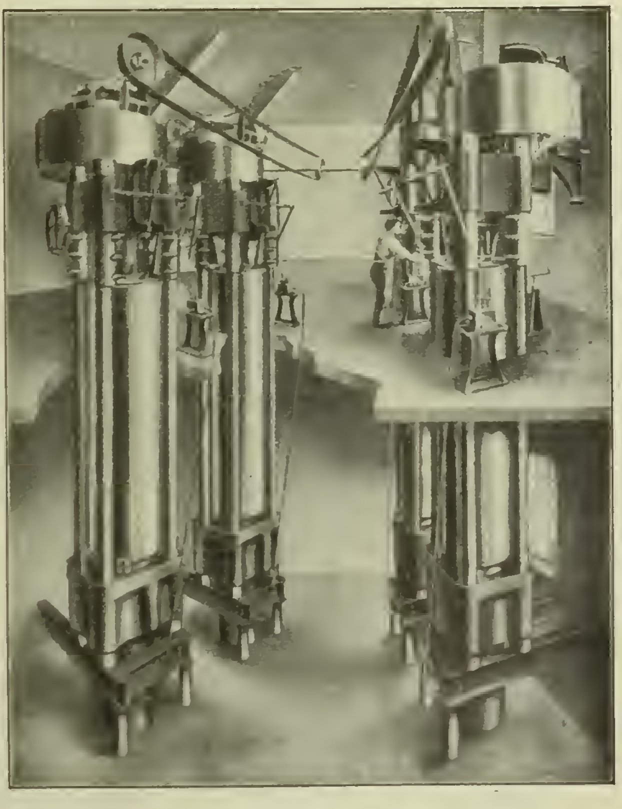

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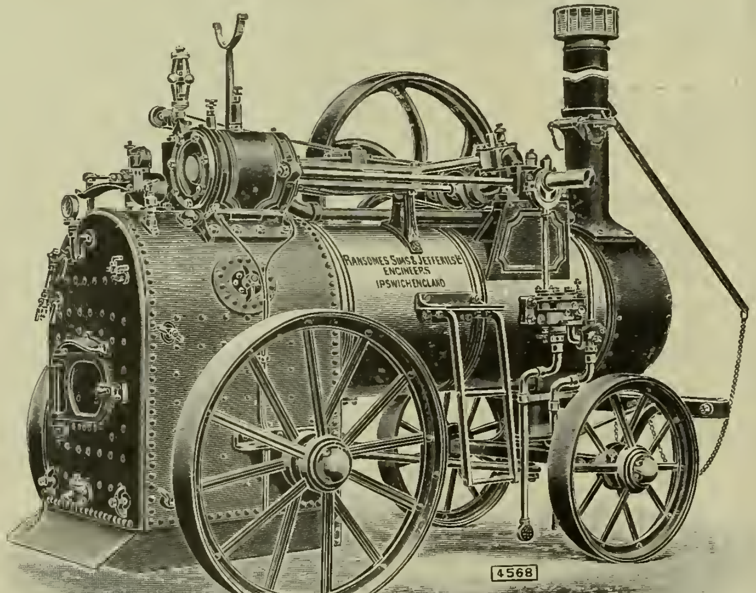
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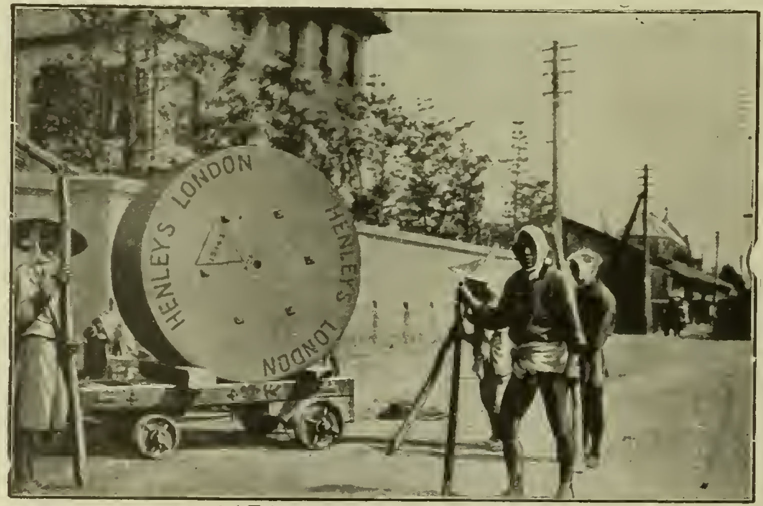

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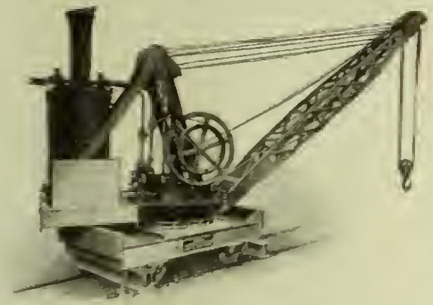

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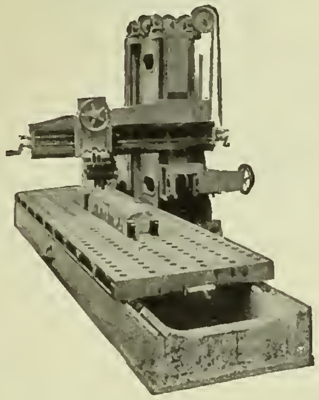

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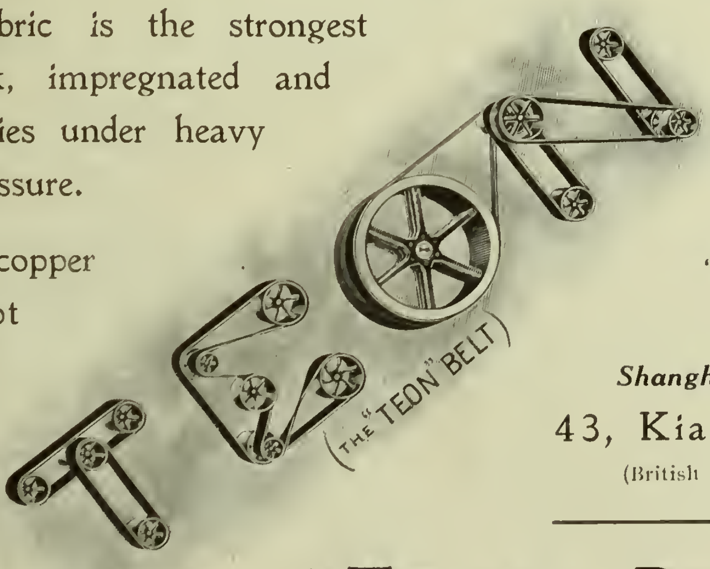

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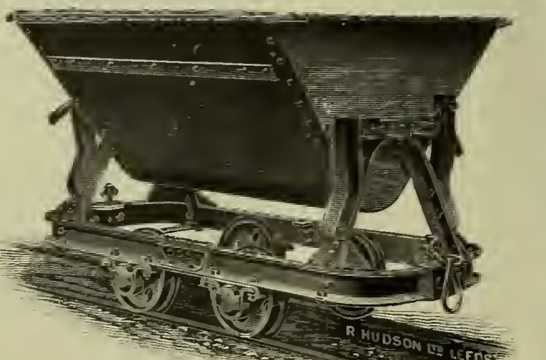

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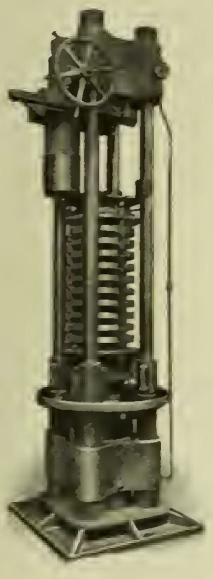

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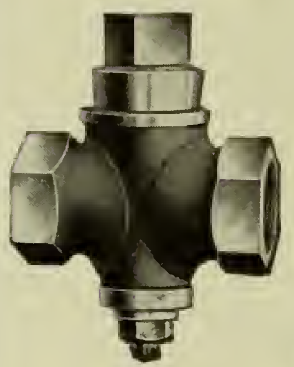

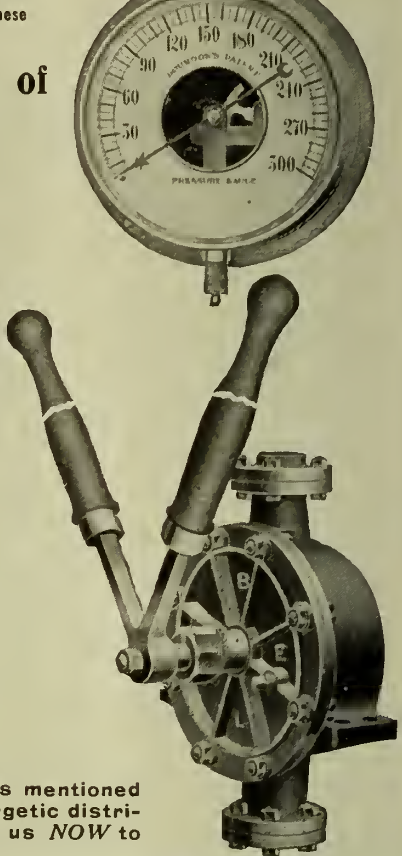

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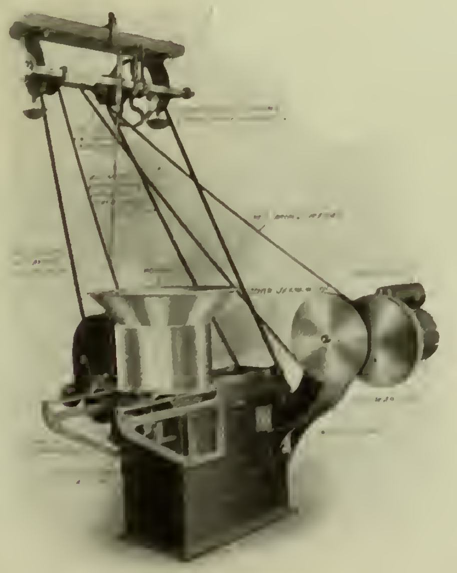

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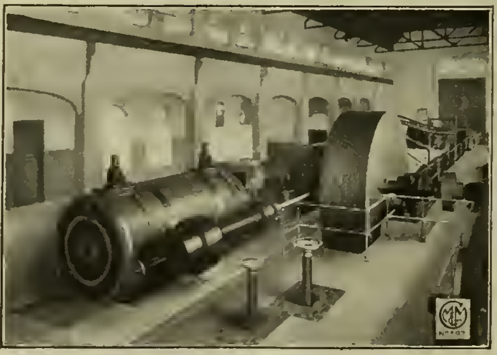

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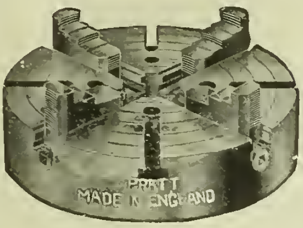

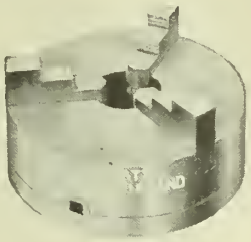

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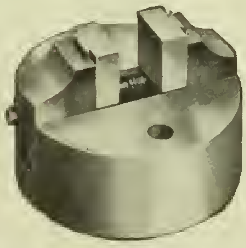

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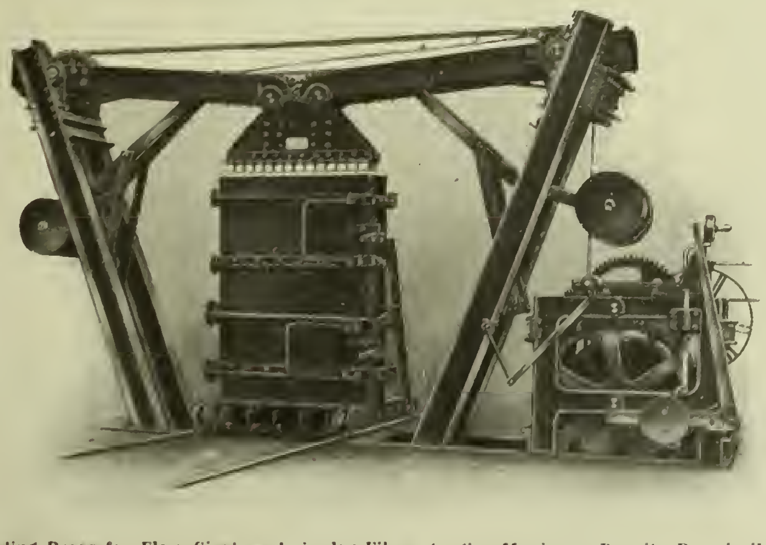

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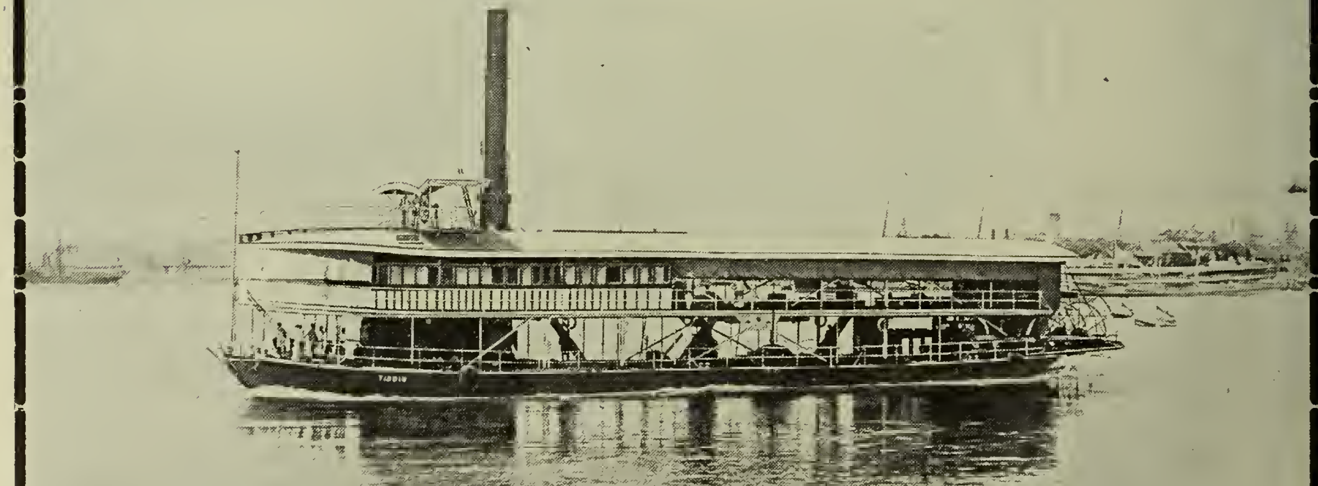

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LETTERS ON ENGINEERING TOPICS,

which touch upon Anglo-Oriental engineering interests are invited, and the Editor will consider articles from contributors on these subjects.

EASTERN ENGINEERING

VOL. XI.—No. 9.] *SEPT. 9, 1920.* [NEW SERIES.

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NOTES AND COMMENTS.

THE BRITISH ASSOCIATION.

The British Association for the Advancement of Science has concluded a very successful annual meeting at Cardiff, over thirteen hundred members attending. Certain of the papers are of practical value to engineering, and a summary of these will appear in the next issue of this journal. Probably through pressure on space, the technical journals this year appear to have condensed their reports of the lectures rather drastically. This is to be regretted, because only in the technical press is such matter properly handled. Speaking to a well-known engineer in London recently, he assured us that manufacturers set little store by technical lectures, but we should be sorry to take this as a considered opinion. We have always found that those concerned in any particular branch of engineering appreciate literature dealing with such branch. Be this as it may, the advice to give closer study to technical literature is sound, and never more so than when offered to students and young engineers. At a meeting of the General Committee of the British Association, Sir T. E. Thorpe, formerly Principal of the Government Laboratories, Emeritus Professor of Chemistry in the Imperial College of Science and Technology, was appointed President of the Association for the Edinburgh meeting next year. Sir Daniel Hall, Minister of Agriculture and Fisheries, and Dr. P. Chalmers Mitchell were added to the Council of the Association. In 1922 the meeting will be held at Hull. Professors H. H. Turner (Oxford) and J. L. Myres (Oxford) were re-appointed general secretaries. Sir Charles Parsons (ex-President) was appointed trustee, in room of the late Lord Rayleigh.

AMERICA ON THE FAR EAST.

While America views with concern the prospects of her shipping industry, representative shipping men, shipbuilders and others foremost in American industrial circles are of opinion that trade with the Far East will continue to grow. It is estimated that with the drop in the value of silver there will be more of a demand for Chinese products in the United States and a resultant shrinkage in the demand for American products, although it is expected that the cry for American machinery will continue strong. Japan, in the throes of reconstruction, due to the war-time period of inflation, is expected to settle down. It is pointed out that there was no vast inflation in China during the war, and prices did not ascend as in other countries. The formation of the new consortium in China will, it is believed, enable municipalities and the Government to enter upon much betterment work, and that the endeavours of the Cabinet will do much to stabilise conditions. Contrary to popular belief, the Chinese have plenty of money, and there should be an excellent opportunity for American companies to swell the volume of their business in the Far East, where the principal demand is for machinery. Whilst Japan is passing through the stage of readjustment, the Government is complimented on the adroit manner in which it handled the situation when the country was threatened with a financial panic. In counting upon development in the Far East we believe that America is building on a good foundation. In the meantime, the doubtful outlook for American shipping is largely due to a subnormal production by the various industries throughout the world; also to the lack of aid America is giving to other nations to permit them to buy commodities and supplies in the United States. To no slight extent the betterment of the position is under American control, and at length this fact is being realised by those who are most concerned.

EMPIRE COTTON.

Working in certain respects in co-operation with the British Cotton-Growing Association, the Empire Cotton-Growing Committee recently put forward a number of important proposals relative to work and organisation. Endeavours will be made to co-ordinate various activities for cotton-growing within the Empire, and to provide up-to-date information for commercial concerns engaged in the industry. The proposals concern the establishment abroad of cotton-growing research stations and the training of men for the various agricultural services entailed in cotton cultivation. The appointment of four Travelling Commissioners is proposed. The Committee's plans include the valuing of cottons and keeping in touch with all markets; where advisable, guaranteeing prices to growers; taking the necessary measures to secure to growers better prices for better cotton; where desired, ginning and marketing cotton; spending money on the promotion of the growing of cotton as compared with other groups. The whole of the central work will be controlled by a General Director, assisted by a staff, and the total cost of such administration is estimated at £25,500 a year. Research and other work abroad will probably cost £20,000 per annum. Importance is attached to the question of supplementing the staffs of local agricultural departments in order to obtain special attention for cotton, and for this purpose it is estimated that it will be necessary to provide a staff of ninety men. Altogether, the Committee is of opinion that an income of about £200,000 ought to be assured. This would include a generous allowance for professorships and lectureships, but probably insufficient for the expenses of the commercial section.

INDUSTRY'S APPEAL TO FINANCE.

Although during recent years many additions have been made to banking facilities in the Far East, it is by no means equally certain that such increased facilities are being turned to the best advantage. If such be the case—and accounts that reach us suggest that it is—then a serious handicap may be imposed on trade development. A network of banks, spread over industrial and commercial centres, provides an invaluable chain of communication. It is essential, however, that those directing such an organisation should be influenced, as far as possible, by an impartial and broad-minded spirit. Hesitation shown in adopting such an attitude, and the disinclination of foreign financiers to invest their capital to any extent in Far Eastern enterprises, does not escape attention in this part of the world. Comparisons between the accommodation offered in these respects by various nations are apt to be drawn, and have a direct effect on trade expansion. In the past German financial institutions pushed the policy of credit to excess. The method was unsound, but it certainly had the merit of steering Far Eastern business into German channels, and even to-day the facilities thereby afforded are not forgotten. It is easy to err in the other extreme to that in which German practice was at fault and thereby prejudice trade. America is finding this the case to-day in her South American markets, and the more generous policy America is now adopting in foreign countries will greatly strengthen her interests abroad. British bankers are emerging splendidly from the strain war conditions imposed upon them. They are well placed for granting facilities in the Far East and materially to assist Anglo-Oriental commerce. The argument British interests now put forward, that bankers should, wherever possible, lend their energies and resources to developing and stabilising such commerce, assuredly represents a sound business policy.

BRITISH TRAINING FOR CHINESE STUDENTS.

We are glad to see that interest in the movement for providing training in British workshops, laboratories, and technical institutions for engineering students from overseas does not weaken. Quite the reverse. It is now very clearly realised that students trained in Great Britain become permanently influenced in favour of British machines and British methods. The instance recently cited of the engineering and shipbuilding works promoted some time back at Canton by a student returned from the United States, who placed orders for the machinery and equipment with the States, is being given wide publicity amongst engineering circles in Great Britain. The Trade and Industry Committee of the Royal Colonial Institute in London has initiated and is carrying out a scheme for providing training for students from British Possessions. The British Engineers' Association has similar work in hand, as also has the British Electrical and Allied Manufacturers' Association, endeavours in both the last-named schemes not being limited to any particular territory. All such plans, moreover, have the hearty support of the Federation of British Industries. It is understood that the British Government has proposals under consideration for devoting the Boxer indemnity to defraying the expenses of the technical education of Chinese students in the United Kingdom. Manufacturers in Great Britain are coming forward and co-operating. The practical assistance of British interests abroad may be safely counted upon, but in this respect a good deal more might be done. The position is distinctly favourable for giving British training to foreign students. The extent to which these facilities are used will depend not a little on the manner in which they are brought to the notice of students abroad. In doing this the aid is solicited of official, engineering and commercial circles in the Far East.

THE MINES AND MINERAL RESOURCES OF YUNNAN.

Yunnan is the most south-westerly of the provinces of China, and its mines and mineral resources form an interesting section in Mr. J. Coggin Brown's ' Memoirs of the Geological Survey of India." Chinese coal-mining methods as practised in the Yunnan are of the most promitive description. Water is not a serious trouble, and owing to the softness of the outcrop coal workings are quickly and cheaply driven. Coal is not often burnt in its natural state in Yunnan, but the material is coked or powdered and mixed with clay and moulded into thin circular cakes for domestic fuel.

The Triassic coals have very variable qualities: those of the Werfen are the best coals in Yunnan and yield an excellent, solid, dense coke. The seams are of great extent; these coals are not so friable as those of the Moscovian or of the Upper Trias. The Middle Trias coal is always deceptive, and was formed under conditions which produced irregular beds distributed in the sandstones. Those of the Noric, on the contrary, appear better; the Ni-ou-ke coal is typical; they produce a friable coke, but they are rich in volatile matter and are gassy.

The analyses of the Mesozoic coals of the Yunnan Hsien basin show that this material is lower in volatile matter than are the Triassic coals of Eastern Yunnan, and with one exception they can only be classed as poor material. Further north, in the Yangtsze valley, the coal of the Ma-ch'ang and Chiu-ya-p'ing Hsien districts, which is probably of the same age as that of the Yunnan Hsien basin, possesses, as Leclère's analysis shows, a higher percentage of volatile matter and a better calorific power than any of the other Triassic coals of Yunnan. It also gives an excellent coke. The seams of this region are mined deeper than those further south. The high ash percentage in both Triassic and Carboniferous coal is partly due to the Chinese practice of not picking out the shale. Analyses of the Moscovian coals shows that they are semi-bituminous and yield a coke of good quality. They are probably better than the Mesozoic coals for steam-raising purposes. The friability of most of the Yunnan coals is a serious defect.

The amount of coal available in Yunnan is largely a matter of conjecture, and it is held that coal does not occur in certain portion of the territory which was formerly held to be coal-bearing. The future of Yunnan coal is chiefly in the local market for domestic and metallurgrical operations, and also for railways. This is due to the land-locked position of the province.

Iron ores have a wide distribution in Yunnan, although none of the deposits appear to be extensive. It is believed that nearly all the larger centres of population have their somewhat small requirements supplied by mines in the same regions. Where any unusual demand has arisen, as in the case of the cast-iron pans used in the brine-boiling industry, there is generally a mine, melting furnace and foundry not very far away.

The tools at the disposal of the miners are of poor quality, and gunpowder does not appear to be generally used. The ore as a rule is carried to the surface in baskets and there broken up and hand-sorted, only the purer pieces being kept, and all the second-grade material rejected. Mining is generally only carried on during the dry season. Most of the mines have been worked at intervals for a number of years.

The largest mines are said to be two stages from Chennan Chou and to be 60 years old. The high Chinese blast furnace used in Central Yunnan for iron smelting is usually built of massive stone or brickwork, enclosed in heavy beams held together by cross pieces. The walls are thick and lined with a siliceous paste. The furnaces are often 20 or 25 ft. high and 6 or 7 ft. across at the widest portion, narrowing to 3 ft. at the hearth and at the mouth. The blast is always produced by a cylindrical blower usually operated by a primitive turbine. The tuyère is generally cut from hard quartzite or sandstone.

Charcoal, which is usually plentiful and cheap, and ore are added in general practice from time to time during the 24 hours which the smelting takes. Two grades of material are yielded by the furnace—(1) flat cakes of crude iron, which are obtained by allowing the molten metal to flow from the tap-hole over the ground; (2) material raked out of front and quenched in water.

There are furnaces and moulds for the manufacture of cast-iron pans at Ma-li-pa and Wan-yao. The furnace used is a small, round-bottomed, tilting blast furnace from four to five feet high. The shaft is broader at the top than at the bottom. The blowing machine is of the type commonly used throughout Western China for most metallurgical operations, and is made from the trunk of a large tree.

The mould used consists of two pieces, both of which are made of thick claywork, and are bound tightly together with ropes in a bamboo framework. The personnel of a foundry of this kind consists of six men, two of whom attend to the blower, regulate its speed and charge the furnace, two others perform the tilting and tapping processes, and the remaining two attend to the moulds and castings. In another shed two moulders are employed, repairing damaged moulds and making new ones. These workmen, with the aid of one surface, can turn out from 30 to 40 bowls per day. They are made in seven sizes, the diameter varying from 29 down to 10 ins.

ENGINEERING, MINING AND INDUSTRIAL PROJECTS IN THE FAR EAST.

JAPANESE PROJECTS IN THE METAL INDUSTRIES.

Japanese copper smelters are proposing to form a combine for the regulation of copper production and prices. The increasing strength of America's position is viewed with concern in Japan. America, of course, controls a large proportion of the South American and Canadian output of metal, but her position should be materially influenced by the great supplies of unworked copper ore which undoubtedly exist in different parts of the world.

A new steel plate plant, said to be the largest in the Far East, and capable of producing 100,000 tons of plate every month, has been completed at Yawata, Kyushu, Japan.

A syndicate of about 15 importing firms and steel merchants of Japan has been formed for the purpose of purchasing resale material being offered by weak holders at what is in many instances one-half of the former market price. The syndicate announces that it did not place orders abroad before August 15. Included in this syndicate are: Mitsui & Co., Mitsubishi Goshi Kaisha, Iwai & Co., Yuasa Trading Co., Masuda & Co., Mogi & Co., Suzuki & Co., Sale-Frazer, Takata & Co., Yonei & Co., Asano & Co., and several steel merchants of Tokyo. The executive committee consists of Mitsui & Co., Mogi & Co., Masuda & Co., Iwai & Co., and five Tokyo steel merchants. Cancellations are still being received, and material being shipped c.i.f. Japan has been offered to Australia and the Dutch East Indies.

RAILWAY ELECTRIFICATION IN JAPAN.

In connection with the electrification of railways in Japan mentioned in our last issue, it is proposed to build a power station at Ojiya, on the Shinano River, capable of producing 250,000 h.p., at a cost of about 100,000,000 yen. The project is to be laid before the present extraordinary session of the Diet for approval. The Imperial Railway Electric Power Company Bill has been passed by the House of Representatives. Mr. Motoda (Minister of Railways) explained that the business of electrifying the railways would be undertaken by the Government, if circumstances permitted, but as the Department of Railways had many other important matters to attend to, it proposed to establish a semi-official concern as an expedient.

WOOL AND LEATHER INDUSTRIES COMMISSION FOR CHINA.

Advices from Peking notify the appointment of a Wool and Leather Industries Commission for China. Endeavours will be made to encourage scientific stockraising and to provide financial assistance towards this end. Wool and leather laboratories and factories are to be established and investigation made into the methods of manufacture adopted in other countries, so that the most up-to-date machinery and equipment may be selected. Facilities will also be established for collection and dissemination of information and reports on the wool and leather industries.

CHINA'S IRON ORE RESOURCES.

A summary of the iron ore resources of China is given in a commercial handbook of China, just issued by the U.S. Bureau of Foreign and Domestic Commerce. Dr. H. Foster Bain, of the U.S. Bureau of Mines, who spent some time in China investigating its mineral resources, estimates that China has 400,000,000 tons of iron ore available and suitable for modern furnace practice, and an additional 300,000,000 tons that might be treated by native methods. The iron ore deposits are now controlled by Chinese or Japanese interests, the Chinese Government aiming to control those that are not already mortgaged to the Japanese. The Penchihu furnaces were producing in 1918 about 75,000 tons of pig-iron. The Anshanchan Iron Works in Manchuria, operated by the South Manchuria Railway, have an annual output of 150,000 tons. The Han-Yeh-Ping furnaces are probably producing an equal amount, which will be increased when the company's furnaces are in operation at Tayeh. Thus a fair estimate of China's production of pig-iron (1918) would seem to be about 500,000 tons a year.

COMMERCIAL MUSEUM AT CHUNGKING.

A movement is on foot to establish a Commercial Museum at Chungking, Szechuan, supported by the Chungking Chamber of Commerce. It is proposed to make as complete a collection as possible of the products of the province, the largest in China. Products of foreign countries will also be included. The Museum authorities will try to provide information on all matters relating to the trade of Szechuan and to be of service to foreign firms at the port.

NEW STEEL WORKS NEAR PEKING.

The establishment is in hand of a modern steel works near Peking on the Yungting River. The first unit of the general project will be a 250-ton blast furnace, the equipment for which has been ordered in the United States.

PROGRESS AT HARBIN.

The opinion of the Consular representatives and of the leading British merchants and bankers in Harbin confirms the previous view that that city is destined to become the centre of Eastern Siberian trade. What is required is the co-operation of foreign industrialists and financiers. The Japanese show considerable activity, and, as previously announced, they have in view to link up Harbin with Possiet by constructing a line from that town to the terminus of the Changchun-Kirin Railway. If they ultimately succeed in securing the portion of the Chinese Eastern Railway running from Changchun to Harbin they will then be in a position to command all the outlets of Manchuria to the eastern part of Siberia. As is well known, Vladivostock is frozen during three months of the year, but Possiet provides all the essentials of a good and natural port.

The most lucrative prospects before industrial development in this territory are shown in coal mining, gas power plant, with chemical by-product recovery, iron mining, iron works, cement works, glass works, canneries, preserve canning, boot factory, flour mills, oil presses, electric tramways. In connection with the above, it must be borne in mind that very extensive coalfields, as well as supplies of various raw materials required for these industries, are situated only a short distance from Harbin.

AMERICAN ENTERPRISE IN DUTCH EAST INDIES.

An interesting example of the energy and enterprise of American commercial methods is described in "Holland's East India," which makes it clear that the United States is fully alive to the importance of developing the East Indian market. The Bureau of Commercial Economies in the U.S.A. has placed at the disposal of the Netherlands East Indian Government a travelling theatre, together with 50,000 ft. of film illustrating the manufacturing processes in connection with various American products.

BANDOENG AUTOMOBILE EXHIBITION.

The British Chamber of Commerce for the Netherlands East Indies is taking special steps to make the British section at this exhibition a success in 1921. In its *Journal* it draws attention to the fact that the aim of the exhibition is to develop means of transport in the Netherlands East Indies. Commercial vehicles of every description will be admitted as well as passenger cars. The transport difficulties experienced by sugar planters afford but one example of the many gaps which are waiting to be filled in this part of the world. Another opening exists for a light commercial car suitable for the transport of postal packets in outlying districts, and for light deliveries and light transport work in its broadest sense.

INCREASED CULTIVATION OF INDUSTRIAL PLANTS.

Amongst the industrial plants of the Far East to which increased attention is now being given, particularly good results are likely to accrue from better cultivation of cassava or manioc. The value of cassava as a source of alcohol has been known for several years, and it is with a view to exploiting its value in this respect that projects for its greater cultivation are now being undertaken. One ton of cassava roots would in practice probably yield from 30 to 35 gallons of 95 per cent. spirit, which compares with 20 to 25 gallons from potatoes and 40 to 60 gallons of 95 per cent. spirit from cereal grain. Two forms of this plant are cultivated, "sweet" cassava (*Manihot palmata*) and "bitter" cassava (*M. utilissima*). The tuberous roots of both forms are rich in starch, and are used as a foodstuff, for the preparation of tapioca and other food products, and as a source of starch for industrial purposes. There is an extensive market for cassava products in the United Kingdom and elsewhere, largely supplied hitherto from the Straits Settlements, Dutch East Indies, and Brazil. Cassava starch has been tried for a variety of industrial purposes with invariably good results, and the flour can also be employed as a bread-making material. A number of alcoholic beverages are prepared from cassava in countries where it grows. It is used in the manufacture of spirits, and is well adapted for brewing purposes.

HYDRO-ELECTRIC POWER IN SUMATRA.

In connection with the concession granted for the purpose of generating hydro-electric power needed for the manufacture of fertilisers for the River Moesi, near Benkoelen, recently detailed in these pages, several features appear to be of unusual interest, and, it is stated, will result in considerable saving of cost in the construction of the works.

Amongst others, special mention is made by H.M. Consul-General at Batavia of the manner in which the dam will be built across the absolutely dry bed of the river, as well as of the proposal to make use of a by-station of 50,000 h.p. in the second year of the work, so that the manufacture and organisation at the factory may be running smoothly and a return be obtained upon the outlay long before the full power can be available for use.

The surveys for the scheme are not yet completed, but it is stated that 150,000 horse-power will be obtainable from the turbines at a cost of, in all probability, 100 guilders per horse-power, and of not more than 133 guilders.

The cost of power per kilowatt-year is estimated to be about 12 guilders.

Several large firms of manufacturers in the United States are stated to be endeavouring to find capital to finance the scheme in the hope of thus being able to supply the necessary plant both for the works as well as for the construction of the same.

IRON DISCOVERIES IN BORNEO AND EAST INDIES.

Explorations carried out in various islands have led to the discovery of iron deposits at Sumatra, as well as at Borneo and Celebes. But while at Sumatra the quantity of iron ore is estimated at only two or three million tons, Borneo and Celebes offer fields for exploitation much more considerable. In the south-eastern portion of Borneo the rock formation of Koekoesan is exceedingly rich in iron, and the hundred millions of tons which it contains, according to the estimate of the engineers, would permit of the creation of an industry which it is hoped will render foreign sources of supply unnecessary. When, during the war, the Indies wanted machines, implements, and so many other products of the iron-foundry, the Government made tho necessary researches in order to learn if and how an industry of this kind could be realised. The coal found in the Indies does not allow of the preparation of coke of the quality necessary for the feeding of the furnaces, and hence the Government has decided to seek for a place where metallurgical operations can be carried out by means of electricity. This is only possible when electrical energy can be obtained at a low price, and as the location of the deposits in the island of Borneo was not favourable in this respect, preference was given to Celebes, in the centre of which iron deposits, estimated at more than a thousand million tons, have been discovered, and where the conditions seem to be most favourable, both on account of its communication with the coast and the facilities for obtaining the requisite electrical energy.

COAL WORKING IN BRITISH MALAYA.

Some years before war broke out coal had been discovered in the Malay Peninsula, in the States of Perak and Selangor. The coal found at Rawang, in Selangor, some 25 miles from Kuala Lumpur, the capital of the Federated Malay States, proved to be of first-rate quality, and as prospection proved a supply of over 10,000,000 tons, the Malayan Collieries, Ltd., was formed to work it and place it on the market. The difficulty of getting plant during the war hindered development, but mining was started in earnest in 1915, when 11,523 tons of coal were obtained. Down to the end of 1918—the latest year for which figures are obtainable—437,388 tons had been mined, and the quantity would have been greater but for lack of plant, shortness of labour, and epidemics of sickness among the workers. The output in 1916 was 101,846 tons; in 1917, 155,279 tons; and in 1918, 168,740 tons. This discovery of indigenous coal is likely to have an important bearing on local industries, which, hitherto, have had to rely mainly on fuel supplies from the native forests. The 168,740 tons mined in 1918 were disposed of as follows:—F.M.S. Railways, 67,437 tons; tin mines, 66,500 tons; other F.M.S. consumers, 14,915 tons; exported, 19,888 tons. This is the first record of coal being exported from the Federated Malay States.

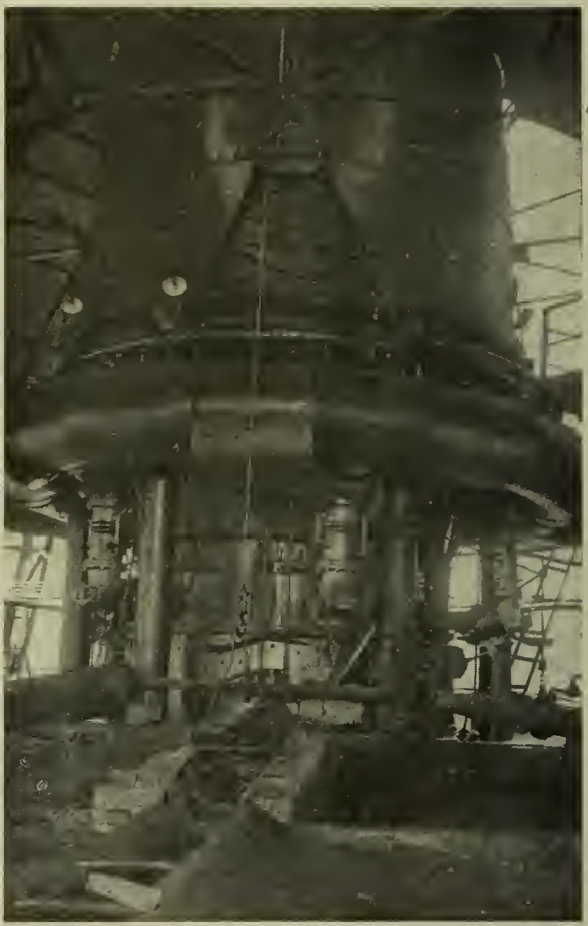
ANGLO-AMERICAN STANDARDS FOR STRUCTURAL SHAPES.

Recommendations for establishing Anglo-American standards for structural shapes, which were formulated at a meeting of a sectional committee organised under the auspices of the American Engineering Standards Committee, have recently been announced through the office of the Secretary of the Association. It is understood that the recommendations will be submitted to the sponsor organisations, to the American Engineering Standards Committee, and to the British Engineering Standards Association, as a basis for common Anglo-American standards. The essential features of the recommendations are:—

(1) The adoption of the decimal system for all dimensions and other elements of order practice.

(2) The adoption as an Anglo-American standard of the standard order practice adopted by the Association of American Steel Manufacturers on February 20, 1920, under which structural shapes are to be ordered by weights per foot and not by thickness.

(3) The adoption of an Anglo-American standard of American standard practice as it relates to ranges of thicknesses, methods of computation, and methods of publication.



Illustrating furnace proper of the new 100-ton Blast Furnace Plant of the Yangtsze Engineering Works, Ltd., at Hankow.

(4) The adoption of definite ranges in thicknesses of angles, bars, and other structural shapes, under which are established two zones of variations between minimum and maximum thicknesses. Under 0.6 in. thick variations are fixed at 0.04 in., and above 0.6 in. thick at 0.08 in.

(5) Included in the list of angles is an equal angle (9 x 9), and four unequal angles (8 x 4, 9 x 4, 9 x 6, and 10 x 4), which are not now rolled in United States, but are subject to the considerations which weigh with manufacturers when new rolls are contemplated.

(6) The adoption of new bulb-angle sections as proposed by the British Engineering Standards Association that are recommended on account of their greater efficiency as compared with present British and American standards.

(7) The adoption of a single set of channel sections with a 5-deg. taper to displace the present two American sets, the structural series with its flange taper 9 deg. 27 min. 42 sec., and the shipbuilding series with its flange taper of 2 deg. This set of channel sections is not quite in accord with that proposed by the British Engineering Standards Association, but is believed to be more suitable

to the requirements of the American trade, and better proportioned.

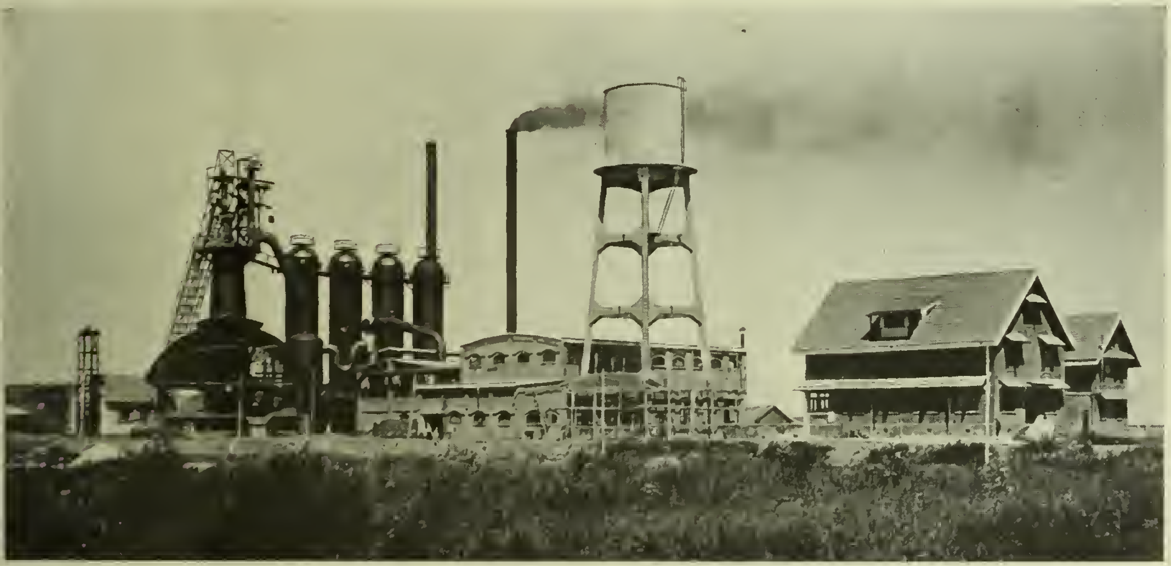
(8) The adoption of a new series of beam sections to take the place of the present American standards adopted in 1896. These sections have wider flanges than present American standards, and do not agree closely with the British proposals, but are believed by the Sectional Committee to be more nearly in accord with the present developments in building and bridge practice.

The report of a conference of steel makers, held on November 19, 1918, convinced that the British standard sections of ship channels and shipbuilding bulb angles appeared to be better adapted to economical manufacture than American standard sections, decided that thereafter rolls not then conforming to British standards be redressed as soon as possible to roll sections conforming as closely as possible to British standards. It was discovered later that these British standards, which were those adopted by the British Engineering Standards Association, had been in the process of revision when the war intervened. When the action of the American steel makers became known in England, Britain offered to co-operate with the American structural trade in formulating common Anglo-American standards for structural shapes.

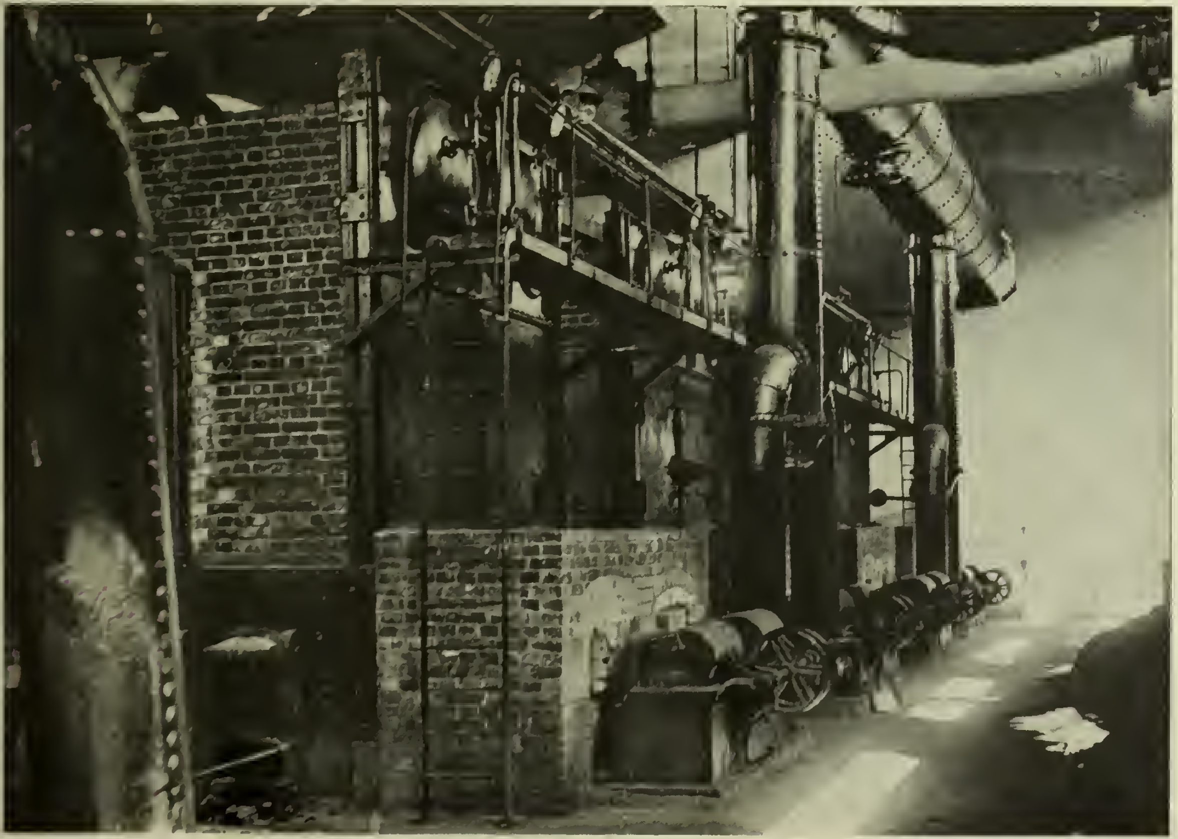
IMPORT DUTIES IN INDO-CHINA.

The modifications and extensions of the French "co-efficient of increase" *régime*, recently made by France, have now been extended to French Indo-China. The French decree of December last reducing the import duty on motor-cars weighing less than 2,500 kilogs., and on detached parts thereof, from 70 to 45 per cent. *ad valorem*, has also been extended to the above-named French colony, whilst co-efficients of increase varying from 2 to 6 have been applied to a number of classes of goods on which the rates of duty under the tariff of French Indo-China differ from those under the French tariff. The greater number of goods thus affected are articles of Chinese origin, but certain classes of cotton yarns, and also tobacco and matches, are included in the list. The co-efficient in the case of cotton yarns (pure, single, unbleached), has been fixed at 3, whilst that for cigars, cigarettes, prepared tobacco, and wooden matches is 5. A number of modifications have recently been made in the export taxes chargeable on certain goods when exported from Germany.

NEW 100-TON BLAST FURNACE, YANGTSZE ENGINEERING WORKS, LTD.



The photographs appearing on this and on the preceding page provide additional illustrations of the new 100-Ton Blast Furnace of the Yangtsze Engineering Works, Ltd., at Hankow, described in our August issue. The top illustration gives a good general view, whilst the bottom photograph shows the Boiler Plant.



AGRICULTURAL AND GENERAL ENGINEERS, LTD.

THE ORGANISATION AND ACTIVITIES OF A LEADING BRITISH ENGINEERING COMBINE.

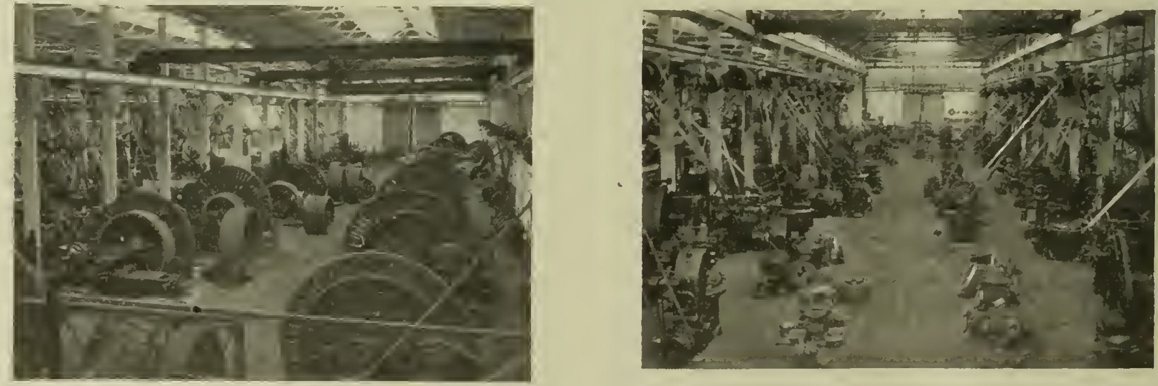
On several occasions brief reference has been made in this Journal to the scope and activities of Agricultural and General Engineers, Ltd., or the A.G.E., as the firm is now very generally styled by the engineering community. As this company embodies some twelve of the best known agricultural machinery manufacturers in Great Britain, its aims and methods are of direct interest to the Far East and to similar territory where agriculture is the greatest industry. At the same time the company covers a wider field than agriculture, as five of its associated firms are famous for their power and transport and road making machinery, whilst a sixth holds a similar position for its flour mill installations. Obviously such a large merger of important concerns has not escaped comment in commercial circles abroad. It is admitted that production will, with efficient management, be greatly augmented and important economies rendered possible with direct benefit to machinery users dealing with the combine. Nevertheless, it is thought that the goodwill of the associated firms, the names of which are for the most part household words wherever machinery is used, may be prejudiced or extinguished by their merger into one concern. But such a supposition will probably prove groundless. This is likely to be the case if publicity is freely and wisely applied in the company's business. Whatever risk is incurred as regards goodwill, should be much more than offset by the increased strength which firms associated with the company derive from the amalgamation. From the point of view of the machinery user the merger is sound, as he is more likely to gain efficient service from the combination than in dealing with the individual manufacturers, notwithstanding the high standard such manufacturers have set in the past. Justification for this assumption is shown in the particulars with which the company has supplied us of its organisation and of the aims which induced its conception and will guide its future activities.

Mr. A. W. Maconochie, Chairman of the A.G.E.

Sir Thomas Robinson, K.C.M.G., Deputy Chairman, A.G.E.

The company states that the present tendency towards amalgamation and association of interests in commercial circles renders a combination of enginering entities only natural. From the League of Nations downwards the present trend of the civilised world is in this direction, and it is only by an elimination of conflicting interests that a nation or community can hope to survive the latter-day struggle for existence.

The present far-reaching shortage of machinery of every description—and more especially of the type indispensable to the world's food supply—renders it imperative that employers connected with this department of manufacture should use every effort to improve their methods and rate of production, and it is primarily with this intention that the constituent companies in this instance have pooled their interests. Although at its inception the new trade-giant embraced only five firms—Aveling & Porter, Ltd., of Rochester; E. H. Bentall & Co., Ltd., of Heybridge; Blackstone & Co., Ltd., of Stamford; Richard Garrett & Sons, Ltd., of Leiston; and James & Frederick Howard, Ltd., of Bedford—there have already been seven further accessions to their ranks necessitating an increased capital of £8,000,000.



Wheel Bay and Steel Gearing Shop at Messrs. Aveling & Porter's Rochester Works.

The later adherents have, as will be readily understood, considerably strengthened the combination, including as they do such well-known names as those of Barford & Perkins, Ltd., of Peterborough; Charles Burrell & Sons, Ltd., of Thetford; Clarke's Crank & Forge Co., Ltd., of Lincoln; Davey, Paxman & Co., Ltd., of Colchester; L. R. Knapp & Co., Ltd., of Clanfield; E. R. & F. Turner, Ltd., of Ipswich; and the East Anglian Engineering Co., Ltd., of Stowmarket.

The association of these old-established industries has naturally required a vast amount of negotiation and preliminary work before the original scheme, formulated in the minds of the directorates of the first five firms, could be developed on a practical working basis. The company has been happy in selecting for its chairman Mr. A. W. Maconochie, whose name ranks amongst those of the most successful business men of the present day. Membership of the Central Board is composed of a director from each individual firm, with Sir Thomas Robinson, K.C.M.G., K.B.E., late Agent-General for Queensland, as deputy-chairman. This ensures adequate representation to each of the firms concerned, and, it is believed, a continuation of the goodwill resulting from the continued use of the old-established names.

The centralisation of executive staff, resulting in internal economies and improved distribution, together with the elimination of competitive manufactures and mass production of specific lines, may, broadly speaking, be considered the main objects of the association.

With the increased capital at their command the various factories have already, and are still, undergoing considerable extensions and improvements. Reorganisation, where necessary, on the most modern lines has been carried out and up-to-date plant and machine tools installed, with the result that the output has been largely increased. Further efforts are constantly being employed, with a view to still further improvements in this direction. Each firm is now specialising on those products for which it is best equipped and large numbers of which it can place on the market rather than, as has so often been the case in the past, handling a multitudinous range of articles in each factory.

One of the most obvious advantages of the new system is that the home and export markets can be economically and at the same time more thoroughly covered by a complete system of agencies and branch houses. While the company feels that direct representation is advisable in certain territories, the fact that agencies have been concluded with such well-known merchant houses as the Borneo Co., Ltd., Turner, Hoare & Co., Ltd., Associated British Engineers, Ltd., etc., will prove that the company's interests are being well handled in the Eastern Hemisphere.

Considerable further advantages accrue to a proper system of buying under centralised control. In this particular sphere the fact that one of the firms concerned is in a position to supply the combination with all its requirements in the way of forgings, crankshafts, etc., will prove of the greatest service.

One of the most unassailable combinations is the inclusion of Aveling and Porter, Ltd., and Barford and Perkins. The former firm are, without doubt, by far the largest suppliers of steam road rollers in the world, and are constantly sending out rollers to the East, while the latter are the pioneers of motor rollers, a type directly applicable to the countries where oil fuel is easily and cheaply obtainable.

Aveling and Porter and the Thetford firm of Burrell and Sons are also large makers of steam tractors, road locomotives and traction engines, while Richard Garrett and Sons have long experience in steam wagon manufacture and have latterly taken up the manufacture of electric battery vehicles, for which an ever-growing market is to be found wherever charging facilities are available.

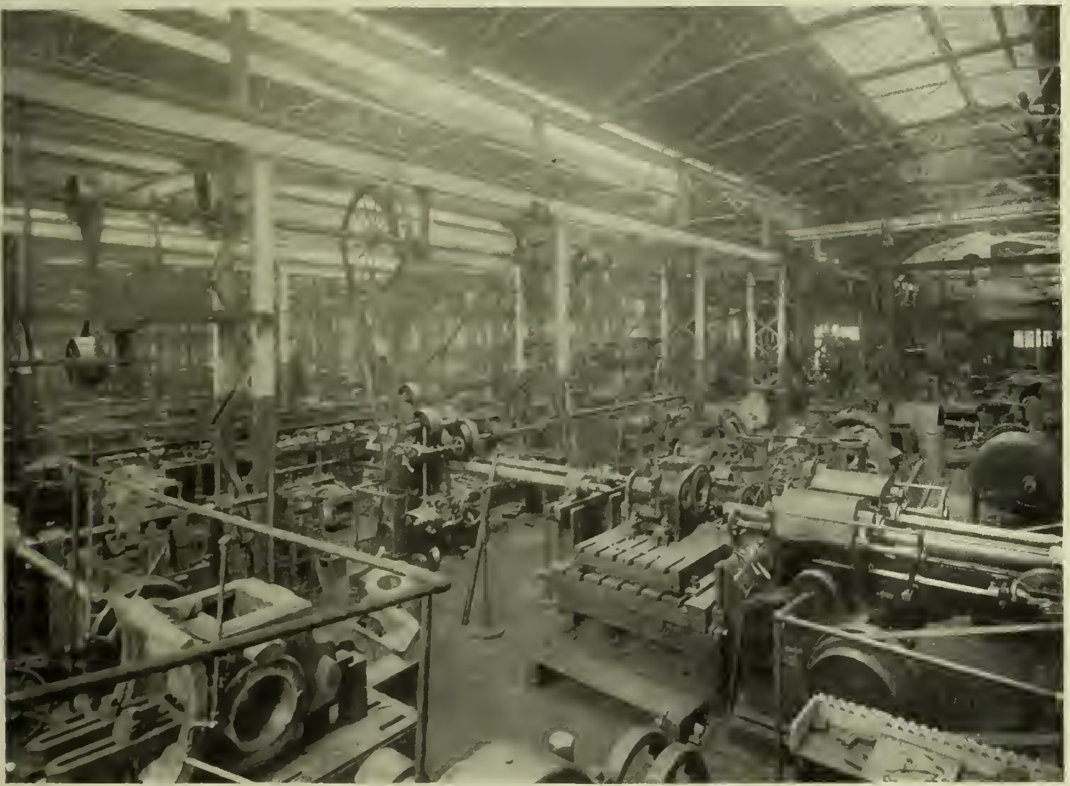
The names of Davey, Paxman and Co., Ltd., as makers of steam, oil and suction-gas prime-movers of large capacity, Blackstone, of Stamford, as crude-oil engine manufacturers, and Richard Garrett (who specialise in their semi-stationary superheated steam installation, combining engine and boiler in one unit) are too well known to merit detailed descriptions. Suffice it to say that the associated companies are in a position to supply steam or internal combustion engines ranging from the smallest ratings up to some 2,000 horse power.

The previous mention of flour milling specialists refers, of course, to E. R. and F. Turner, of Ipswich. This firm's works are laid out for the supply of complete mill installations. They have, moreover, tackled the question of rice milling with great success.

The East Anglian Engineering Co., Ltd., makers of electric motors, dynamos, and controlling gear, constitute a further asset, especially on account of the fact that they act as suppliers of the electrical apparatus in connection with the Garrett electric battery vehicle. This firm have, moreover, a considerable trade in special motors for blowers and kindred uses.

Turning to the purely agricultural side of the company, it will be seen that several of the associated firms' outputs are entirely concentrated on machinery of this class. An item of considerable interest to the Colonial and foreign buyer is the large direct ploughing engine, manufactured by Aveling and Porter. This is of the side-by-side compound cylinder type, and it fitted with a large horizontal drum and wire rope for cable ploughing. An interesting point in connection with the Rochester firm is the fitting of balanced piston valve gear to their various engines, largely reducing internal friction and increasing the power available at the road-wheels, flywheel, etc.

Barford and Perkins, Ltd., besides being by far the largest producers of motor rollers, have also specialised in horse and hand-drawn types. They have a large output of patent lever hay and straw presses, steam food-preparing apparatus and boilers, and combined corn grinding and crushing mills, the grinding plates and crushing rollers being worked independently and being, therefore, both capable of operation at the same time.



Lathe Shop at Messrs. Garrett's Leiston Works.

The Heybridge works of E. H. Bentall and Co. are principally engaged in turning out their well-known hand and power chaff cutters, green bone cutters, unchokable root cutters, maize kibblers, oil cake mills, corn grinding mills, and similar implements, as well as their special fruit farm ploughs and small oil engines. Messrs. Bentall's are, moreover, large makers of bright steel nuts and bolts, and of shafting, wall brackets, plummer blocks, etc.

The Burrell traction engine, mention of which has already been made, is, of course, largely used for agricultural purposes, and Messrs. Blackstone and Co., besides their paraffin and crude-oil engines, have also been most successful with their creeper track agricultural tractor of the caterpillar type, illustrated in the August issue of this journal, a large future for which lies in the export market. This firm also supplies swathe turners, haymakers, horse-rakes, and a complete electric lighting outfit for farm houses and other isolated buildings beyond the reach of the central station electric mains.

The main agricultural products of Richard Garrett and Sons are their corn and rice-threshing machines, maize and mealie shellers, clover hullers, straw elevators, and steam portable engines. Messrs. Garrett can claim to have been the first English makers to export threshing machinery from England.

There is probably no farmer who is not acquainted with the name of Howard in connection with the plough industry. Messrs. Howard's harrows, baling presses, straw trussers, and cultivators are also well known throughout the world, and the firm have just produced a new model of the latter implement, the "Bull-dog," which should have a ready sale in the Eastern market. They also manufacture portable railway plant on a large scale.

For corn and seed drills and manure distributors Messrs. L. R. Knapp and Co., Ltd., of Clanfield, are held in high repute, and drills of all descriptions are supplied to meet varied requirements.

One of the most striking features of the firms associated under Agricultural and General Engineers, Ltd., is the length of time which they have been established in business. Three of the firms date from 1745, 1770, and 1778 respectively, and the average life of the twelve constituent companies is no less than 95 years. At present the Company's Head Offices in London are at Central House, Kingsway. The Company recently acquired an important large building site in Aldwych, adjacent to Kingsway. Upon this site commodious office and showroom accommodation will be erected, and the illustration below depicts this building as it will appear when completed.

The Future Headquarters in London of Agricultural and General Engineers, Ltd.

HEAT AND POWER FROM VEGETABLE WASTE AND REFUSE.

A good deal of interest is now being given to an improved type of plant for the utilisation of vegetation and wood as fuel to produce gas for internal and external combustion and for the rapid production of charcoal for use in connection with gas engines. The plants work under what is known as the Wells system, the methods having been worked out by Mr. John Wells, formerly Inspector of Mines for Egypt. Mr. Wells has been for long connected with problems of cheap production of power in undeveloped countries and we are indebted to him for the following particulars of his system. The Wells Vegetable Fuel Power Company, Ltd., has been formed in London to take up and deal with Mr. Wells's inventions and to supply plants made in accordance therewith.

One difficulty in using vegetable and wood waste in gas producers is its bulkiness, which involves the problem of so constructing the furnace and hopper as to permit the fuel to be fed in with sufficient rapidity. Under the Wells system a machine has been designed on the lines of the common chaff-cutter, only of heavier and stronger construction, which cuts such matter as cotton stalks and similar fuel into two-inch lengths and reduces the bulk of a ton from 20 to 3¾ cubic metres. Larger and heavier machines, known as "breakers," are made for dealing with fuels such as brushwood.

For feeding the fuel into the smaller sizes of producer a standard feed hopper is employed, designed to prevent wedging or jamming. The receptacle has two extreme positions. When it is being filled with fuel it stands in one position, a slide which forms an extension of its bottom casting then closing the mouth of the producer. When the latter has to be charged, the full hopper is traversed to the opposite position; the fuel is then free to fall down through the mouth of the producer, without permitting either the escape of gas or the entrance of air, since the feed hopper is provided with a lid.

An appropriate form of step or ladder grate has been adopted to enable the large amount of ash to be disposed of with facility.

Instead of being circular, as is commonly the case, the producer, like the subsidiary plant, is rectangular in plan, and is built up of standard interchangeable rectangular cast-iron plates, measuring 2 ft. by 1 ft. This method not only facilitates transport of the plant, but plants can be made up from stock.

Gas to be used in driving gas engines is suitably treated, and it is found that there is no appreciable variation in the effective h.p. of a given gas engine, whether the fuel used is anthracite or vegetable refuse.

The gas may, of course, be burnt under steam boilers, for which purpose specially suitable equipment is supplied. In places where wood is abundant the gas producer may be modified to act as a charcoal producer. Apparatus for the recovery of by-products, such as methyl alcohol and acetone, may be installed if desired.

Not only does the Wells system overcome the difficulties that have hitherto hindered the more general use of waste vegetable tissues prevalent in certain Far Eastern industries, but as developed in its present form it is in fact a destructor of very simple design, which can be depended upon to produce gas of good average quality from material such as town, house, and dustbin refuse, which have not hitherto been successfully used for the production of gas.

RECENT EXCAVATOR PRACTICE.

The development during the past decade of the steam excavator, commonly known as the steam navvy, has steadily proceeded and its field of utility materially enlarged. Such progress is of interest and importance to the Far East, which, from an engineer's point of view, must be considered very much in the light of new territory, where projects connected with civil engineering, such as railways, docks, canals, and public works, are so essential to expansion. Moreover, with the introduction of new and the improvement of existing types of excavator, the scope of the machine is no longer limited to contractor's work, but now embraces more or less permanent duties in open mines and quarries and similar industrial undertakings which have great prospects in the Far East. Particulars of the most interesting types of modern machines and of modern methods in excavating were given in a paper recently read before the Institution of Mechanical Engineers by Messrs. F. H. Livens and W. Barnes. The authors showed that the original steam navvy, which was capable of swinging or slewing its excavating gear through a little more than half a circle, has been now displaced to a large extent by the full-circle machine, commonly known as the steam-crane navvy, and developments of this latter type are what the general user finds so useful for his work.

The size of the machine most suitable for various workings is governed chiefly by the nature of the material to be excavated and the output required per day. The former will determine the minimum cutting effort to be used. For example: 4 to 6 tons is suitable for material up to clay of medium hardness; 8 to 10 tons is suitable for stiff clay; 12 to 20 tons is suitable for boulder clay; 20 to 30 tons is suitable for heavier material, such as limestone and heavy iron-ore.

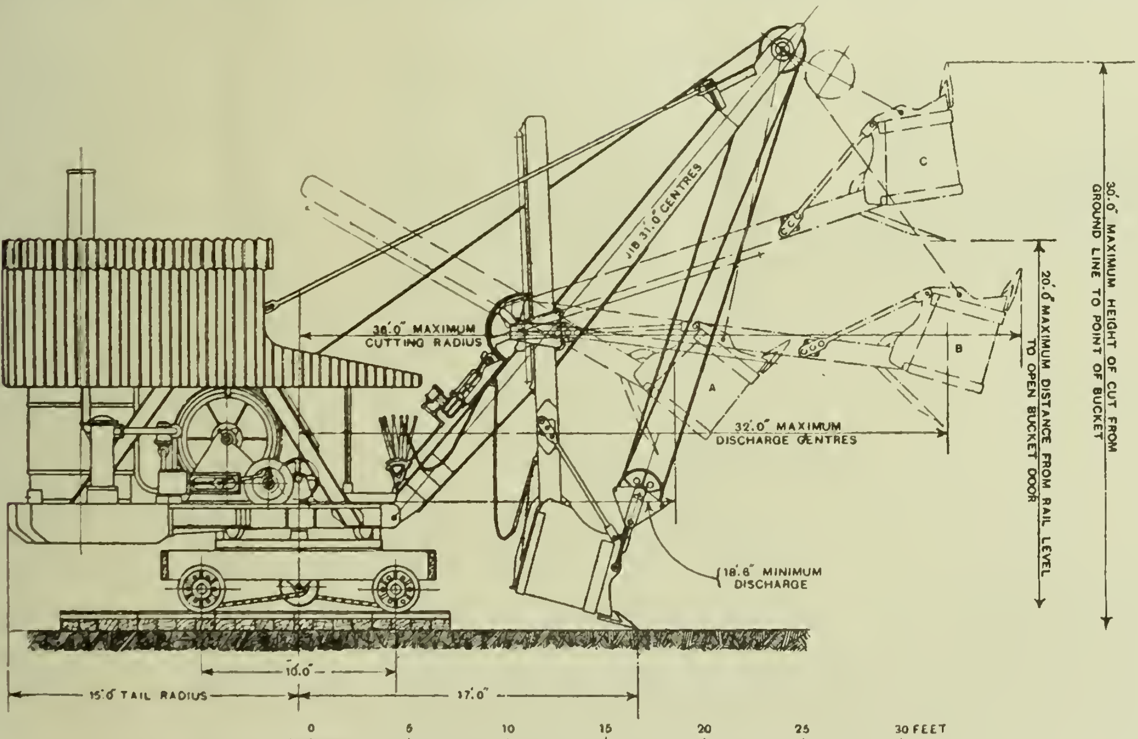

JIB 31.0" CENTRES
C
30.0" MAXIMUM HEIGHT OF CUT FROM GROUND LINE TO POINT OF BUCKET
20.6" MAXIMUM DISTANCE FROM RAIL LEVEL TO OPEN BUCKET DOOR
36.0" MAXIMUM CUTTING RADIUS
B
A
32.0" MAXIMUM DISCHARGE CENTRES
18.6" MINIMUM DISCHARGE
10.0"
15.0" TAIL RADIUS
17.0"
0
5
10
15
20
25
30 FEET

Fig. 1.—Typical General Purpose Crane-Navvy. total weight, 55 tons.

The output depends also upon the size of the bucket, which again is governed by the nature of the material to be excavated: thus a machine having 6 tons cutting effort is most efficient when fitted with a bucket of $\frac{3}{4}$ to 1 cubic yard capacity; if 12 tons, then the bucket should hold from $1\frac{1}{2}$ to 2 cubic yards; and if 20 tons, from $2\frac{1}{2}$ to $3\frac{1}{2}$ cubic yards, to give approximate examples.

The machine in Fig. 1 is the type and size of machine in most general use, and is also interesting from the modifications which can be made in it to meet various conditions of working. Its weight is 55 tons net or 62 tons in working order. With the length of jib shown, the machine has sufficient stability for 20 tons cutting effort on the bucket teeth, or, if used as a crane, it will lift a load of 20 tons.

It is supplied with a bucket of $2\frac{3}{4}$ or $3\frac{1}{2}$ cubic yards capacity, having a renewable mild steel lip-plate carrying steel teeth with renewable points of manganese steel. The main frame has the travelling gear on the underside, whilst the top face or platform carries a combined gear-ring and roller path, upon which the whole upper structure and excavating gear revolves. Two sets of travelling wheels are fitted, one set to standard gauge, usually 4 ft. $8\frac{1}{2}$ in., for use in moving the machine any considerable distance on a railway track; the other, a broad gauge set to carry the machine when excavating. The bucket arm is fitted with long racks gearing into pinions driven from a set of small, self-contained engines fixed on the jib, which vary the cutting or discharging radius of the bucket, the bucket arm being racked in or out as desired.

The digging motion is operated by a wire-rope on a hoisting drum of a more or less conventional type driven through a friction clutch, actuated by a steam-cylinder for easy and quick operating. The drum is loose upon the drum-shaft and, when free of the clutch, is under the driver's control by means of a foot-brake.

The slewing motion is either driven from the main engines used for hoisting, through a set of reversing friction clutches and the usual gearing, terminating in the gear-ring on the main frame, or in some machines by a separate set of engines which is a duplicate of those on the jib.

The travelling motion is taken off the main engines through a train of gearing connected to bevel gears at the top of the centre post, the power being transmitted from these by a vertical shaft through the centre post to the gearing under the main frame.

Fig. 1 shows various positions of the bucket. A is the position of the bucket when it is racked in to the minimum discharging point; B is the extreme cutting and discharging radius, whilst C shows the highest point to which the bucket can be hoisted; this indicates the depth of cut which can be taken without under-cutting the material. It is evident that there are certain conditions of working which are beyond the possibilities of B and C on the standard machine, but these can be met by increasing the lengths of the jib and bucket-arm, and correspondingly decreasing the cutting effort and the size of the bucket.

An interesting modification of the above machine is the combined steam-navvy and grab. It is a dual-purpose machine, and will not only excavate, but will take up overlaying material. Two hoisting drums are fitted to the main drum-shaft, one for use with the steam navvy bucket and the other for use with the grab. Either of the drums can be connected or disconnected at will. An extended jib and bucket arm may be used to enable the excavated material to be discharged at a greater distance. This naturally decreases cutting effort, to avoid which a normal length of jib working in conjunction with a transporter may be employed.

This type of machine is illustrated (Fig. 2). The transporter travels in the bottom of the quarry. The underframe is fitted with the necessary wheels and travelling gear which enable it to be moved about the quarry under its own power, and on the underframe are the boiler and winding engines for actuating the transporting gear, which are sufficiently large to haul a fully-loaded skip up the inclined track at a speed to suit the excavator, and, in addition, supplying the power for travelling. The skip is about 25 per cent. larger than the excavator bucket to avoid spillage. It is fitted with a hinged door similar in principle to the bucket of the digger, but arranged so that it can be opened at any desired point along the transporter track by means of a movable tripping jack, which is traversed by a small hand-winch on the transporter, within easy reach of the driver. Compared with a long jib-crane navvy of equal bucket capacity, the plant is capable of a larger output. It is very economical, the only disadvantages being the extra man employed as driver of the transporter and the necessity of moving and laying a track for two machines instead of one.

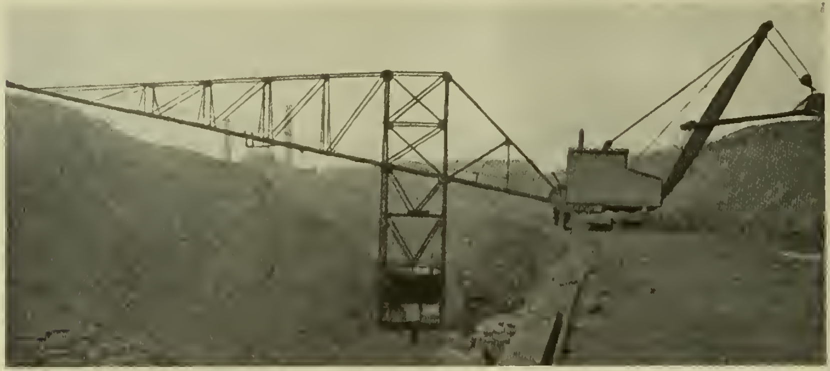


Fig. 2.—Crane-Navvy working in conjunction with a Transporter.

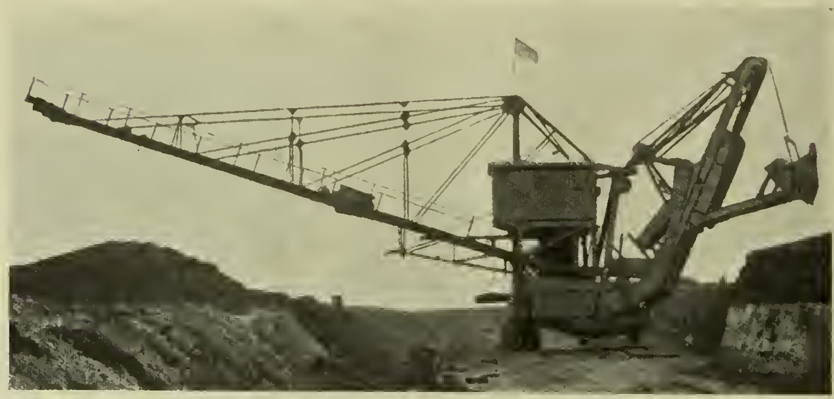


Fig. 3.—Combined Excavator and Transporter, removing cover from Ironstone.

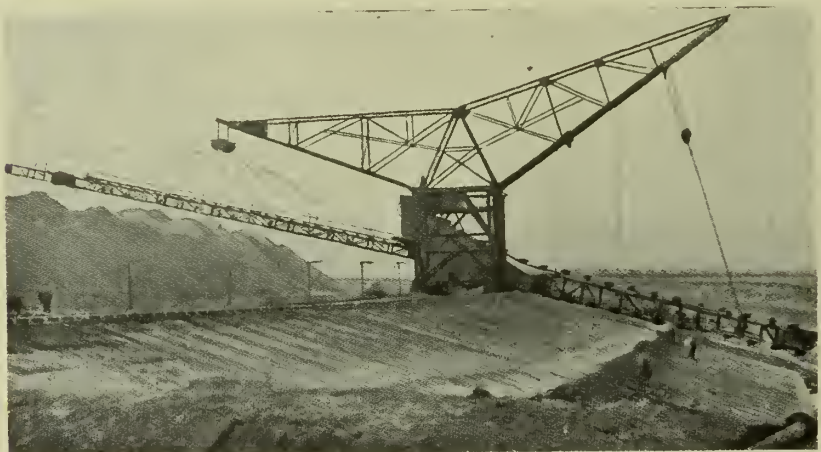


Fig. 4.—Endless Bucket Excavator combined with Belt Conveyor.

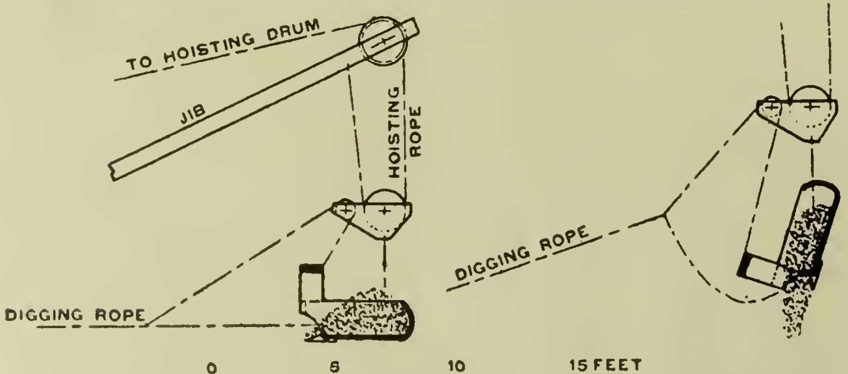


Fig. 5.—Illustrating Method of Working of Dragline Excavator.

An endless carrying belt is occasionally used in place of the skip, fed from a revolving pan at the foot of the transporter, into which the excavator discharges. The advantage of this arrangement is its lighter weight compared with the track for the skip on account of the distributed load on the belt, as against the concentrated load of the skip. Its disadvantages are the greater maintenance charges—chiefly belt renewals—and the fact that the discharge takes place at one point—the end of the belt. If the ground has not to be left level again, but can remain in the ridge formation caused by the discharge from the belt-conveyor, the latter point does not count, but as generally the land has to be put back into cultivation, much additional expenditure is incurred if the levelling has to be done by hand.

A simple machine combining the advantages of both excavator and transporter is shown in Fig. 3. The machine is a single-bucket excavator carrying a wagon transporter supported by a common tower and main frame, and weighs about 85 tons. The method of discharging the material into the wagon is its most novel feature, as, instead of the bucket being swung round over the wagon in the usual way, the hoisting is continued after the cut is finished, until the bucket is pulled right into the jib and immediately over the top of a chute fitted between the sides of the jib. Just as the bucket is coming over the mouth of the chute, the catch holding the door in place is mechanically pulled off, the door falls, and the contents of the bucket are discharged down the chute into the wagon standing on the transporter track at the foot of the chute.

When the material is light and easy to dig, the endless bucket type of excavator, feeding on to a belt conveyor, may be a very useful and efficient combination, as shown in Fig. 4, which illustrates the largest machine of its kind. and is operated electrically by a three-phase current.

Where labour is scarce, small crane-navvy machines are increasingly in favour amongst small contractors, brick manufacturers, quarry owners, and others. In general design these smaller machines are similar to the larger machines previously described. They weigh, however, only about 16 tons net, carry a bucket of about ⅜ of cubic yard capacity, with 5 tons cutting effort on the teeth. Many modifications of these small machines are possible to enable them satisfactorily to deal with a variety of materials.

The single-bucket excavators already described have three characteristics—they excavate above the level on which they stand, they dig away from the machine, and they advance into the excavation as it proceeds. The machine shown in Fig. 5 works in an exactly opposite manner in all three respects, and the bucket is dragged towards the machine on a flexible rope instead of being guided by a radial arm. This type of machine is very useful for drainage work and for situations where the ground is too wet for a machine to stand in the bottom. In construction it is similar in many respects to a crane-navvy: in fact, the latter may be designed so that, by adding an additional drum to the hoisting engines and fitting a longer jib to the special bucket, the machine can be converted into a dragline.

The method of working is as follows: The bucket is lowered out at its extreme radius to the foot of the excavation, the digging drum is put into gear, and the bucket is dragged into the material towards the machine, the thickness of the cut being regulated by means of the tension on the hoisting rope. If the cut is correct the hoisting drum unwinds freely. A thinner cut can be taken by braking the hoisting line. When the bucket is full the digging clutch is thrown out and the hoisting gear put in. The bucket is then lifted on the hoisting rope, and the digging rope is allowed to run out under the control of the brake so as to swing the bucket towards the front of the jib. The machine is then slewed over the dumping point and the bucket discharged. The bucket can be swung out beyond the jib-head radius to take a larger radius of cut by drawing in the empty bucket on the digging line, and then letting it run out as freely and as fast as it can so that it swings beyond the jib-head.

The following table gives some comparative working information of some of the machines illustrated or described. Time lost, referred to in the right-hand columns, includes time employed in waiting for wagons and in moving up:—

Net Weight and Type of Machine.	Material Excavated.	Average output per hour inclusive of lost time.	Average output per hour exclusive of lost time.
55 tons Crane Navvy ...	Ironstone fairly easy to dig	125 tons	196 tons
55 tons Crane Navvy ...	Heavy Ironstone	117 tons	167 tons.
56 tons Long Jib Crane Navvy, 60 ft. discharging centre ...	Sand	81 cubic yards.	107 cubic yards.
55 tons Crane Navvy working with Transporter	Stiff clay and loam	156 cubic yards.	213 cubic yards.
43 tons Crane Navvy working with Transporter	Stiff clay and loam	160 cubic yards.	176 cubic yards.
85 tons combined Excavator and Transporter	Stiff clay and sandstone	160 cubic yards	134 cubic yards.
120 tons Crane Navvy	Very heavy ironstone	161 tons	321 tons

Compared with the results shown above, an average man can excavate from 1 cubic yard of clay or ironstone to 2 cubic yards of sand per hour.

COAL MINING IN JAPAN,

Although coal production in Japan has been large, exceeding that of India, and a large tonnage of Japanese coal has been available for export and sale at fairly cheap rates, there has been a sudden decrease recently in Japan's output returns. The decline is attributed to the decrease in the consumption through the general curtailment or suspension of work in industrial centres, which has compelled the mines to stop or cut down their output. The quantity used for industrial purposes throughout Japan is about 16,000,000 tons per year as an average, which figure, it is estimated, will fall to 13,000,000 tons, or even less, due to much easier conditions in many factories. As most of the mines are restricting their output in view of the falling off in the quantity consumed, there will be no fear of over-production and the consequent fall in market prices. The price for the superior quality, such as the Hokkaido and Kyushu coal, is rather firm, and stands a chance of holding its own, as the mine-owners and holders of stocks are mostly possessed of large means, and do not wish to sell their holdings for the purpose of raising funds.

The export of Japanese coal to the Straits Settlements and other places last year amounted to 2,000,000 tons, as against 2,180,000 tons in 1918. The output of the Fushun coal-mine in Manchuria during last year amounted to 2,700,000 tons. Since the beginning of the present year the output of this mine has shown an increase, and in January amounted to 300,000 tons. It is anticipated that the total output this year will reach 3,600,000 tons.

There is little doubt that the labour difficulties now being experienced in Great Britain and in America favourably affect coal-mining in the Far East.

THE EVOLUTION OF THE INTERNAL COMBUSTION ENGINE.

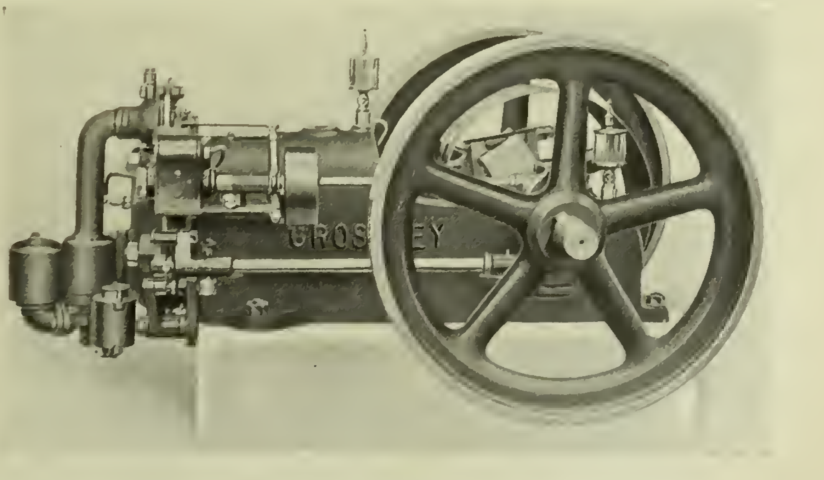
The efficiency of the internal combustion engine of to-day is one of the triumphs of scientific engineering, and the rapid development of this form of motive power is a striking example of modern progress. Sixty years ago the internal combustion engine was in the purely experimental stage. To-day its service is universal and its application in industry and agriculture is world-wide. The credit for this achievement is due to those firms and individuals who by their enterprise and efforts rendered possible this advance. Foremost among these stands the well-known British firm of Crossley Bros., Ltd., of Openshaw, Manchester, which has been responsible for a large share of the pioneer work in this direction, and whose history has been from the outset the history of the evolution of the internal combustion engine.

Founded in the year 1866 by the brothers F. W. and W. J. Crossley, the firm of Crossley Brothers entered upon its career in Great Marlborough Street, Manchester, with the strength of some 200 employees. Before that date gas-engines had already been made, but not in any quantity, and this firm holds the proud distinction of having been the first to manufacture a commercially successful gas-engine. The Otto and Langen atmospheric gas-engine, to give the original type its full name, was noisy and limited in size to 3 or 4 h.p., but its success was immediately assured on account of its remarkable economy in gas consumption compared with any engine previously built. Ten years later, in 1876, Messrs. Crossley Brothers introduced the Otto silent slide valve engine, which worked on the well-known four-cycle principle. This engine was the forerunner of the modern gas-engine, and the four-cycle principle still holds the field to this day.

The popularity of this form of power was fully demonstrated by the growing demand for their engines which Messrs. Crossley Brothers experienced, and it was soon evident that the works in Great Marlborough Street were not large enough for their requirements. The number of employees had gradually increased from 200 to 500, and in 1881 the firm had been formed into a private limited company. Lack of space prevented any further extension of the original premises, so a site of about 14 acres was acquired at Openshaw, Manchester, and new works were erected there. By 1883 all preparations were complete, and the whole business was transferred to the new works in the summer of that year.

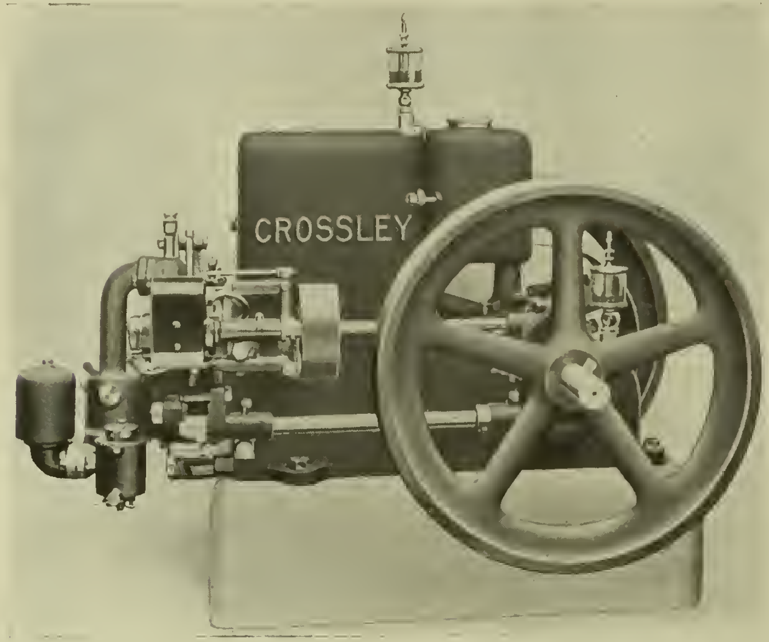
In these more commodious surroundings the production of gas-engines was continued on a much larger scale, and many improvements and modifications of the existing types were carried out. One of the most important of these was the introduction, about the year 1888, of tube ignition, which eliminated the wear and tear of slide valves and also allowed the compression, and consequently the power of the engine, to be considerably increased.

It was about this time that the attention of engineers was turned to the oil engine, and although its invention dates back to 1872, development had only reached a very preliminary stage. In 1891 Messrs. Crossley Brothers put their first oil engine upon the market, and from that day to this they have worked unceasingly to improve and simplify both these types of internal combustion engines.



Farm Oil Engine for separate Water Cooling.

Most oil-engines of the past, and many of the present day too, needed the continual care and attention of a highly-skilled engineer, but this firm decided to work on more simple lines altogether, and, avoiding the "Diesel" type of engine, with its complicated mechanism, eventually succeeded in producing an engine of practically the same economy that could be looked after by an ordinary intelligent attendant. These early engines were designed to run on petroleum oil, which was not only conveniently stored and transported, but also in those days plentiful and cheap. To-day, however, the lack of supply and ever-increasing demand for this class of oil has made this fuel comparatively dear and sometimes difficult to obtain. Under these circumstances the recent introduction of the new Crossley Oil-Engine for using crude and residual oils, as well as the more refined classes of oil if desired, comes at an opportune moment, especially for those power users who are situated within easy reach of these cheaper varieties of heavy oils.

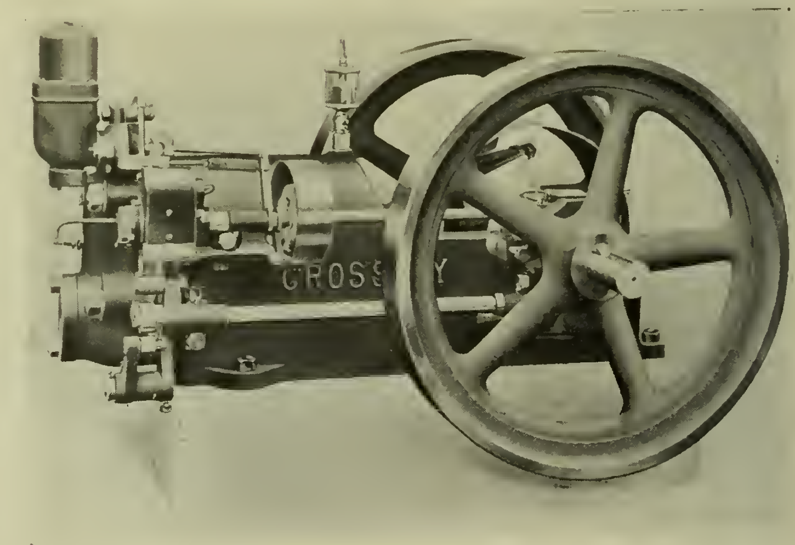

Farm Oil Engine (Hopper type) with Oil Tank and with Hopper for Cooling Water.

In 1897 Mr. F. W. Crossley died, and the firm was in that year incorporated as a public limited company, with Mr. W. J. Crossley at its head.

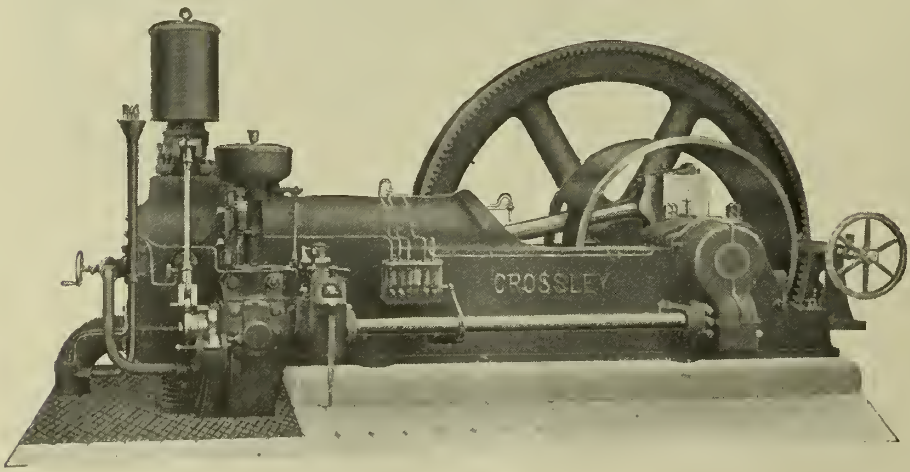
Up to this date Messrs. Crossley Brothers had confined their attention to gas and oil engines, but in 1901 they laid the foundation of what is to-day a most important branch of their business—the manufacture of producer gas plants. Producer gas had been in use some years, and Crossley gas-engines had often been adapted to use this instead of town gas with success, but gas plants had not reached a sufficiently high standard of reliability to warrant their extensive adoption. The most usual form of gas plant at that time was the pressure type, and Messrs. Crossley Brothers, Ltd., were among the first to bring forward the suction gas plant, which has of late years almost entirely taken its place. The economy of the present-day suction gas plant is, Messrs. Crossley claim, not approached by that of any other power producer, and the application of its principle to the gasification of waste fuel, such as spent tan, wood refuse, cotton seed, and other refuse fuels, has enabled many firms in every part of the world to obtain their power absolutely free of cost from their own waste products.

The ten years from 1901 to 1911 must be classed as a period of expansion and development in the history of the firm. During this time many new principles were incorporated in the design both of gas and oil engines. Perhaps the most important of these was the introduction of variable admission governing and forced lubrication on all models. The former varied the quantity of the mixture according to the actual load on the engine, and produced, by the absolute regularity of the explosions, a silent, smooth-running engine giving long life and reliability and an economy impossible with the old-fashioned "hit-and-miss" type of governor. The latter ensured perfect and automatic lubrication of all main bearings directly the engine was started, and eliminated all risk of damage due to negligence on the part of the attendant.

Always progressive in their policy, the firm of Crossley Brothers, Ltd., have built up a world-wide reputation for the quality and efficiency of their engines, a reputation which has been further enhanced by the numerous "first" awards won at competitions both in Great Britain and abroad, and by the outstanding successes achieved at many international exhibitions.


Farm Gas Engine.

In 1911 Sir William Crossley, who had been made a baronet not many years previously, died, and his place was taken by his eldest son, Sir Kenneth Crossley, who is the present chairman of the company.

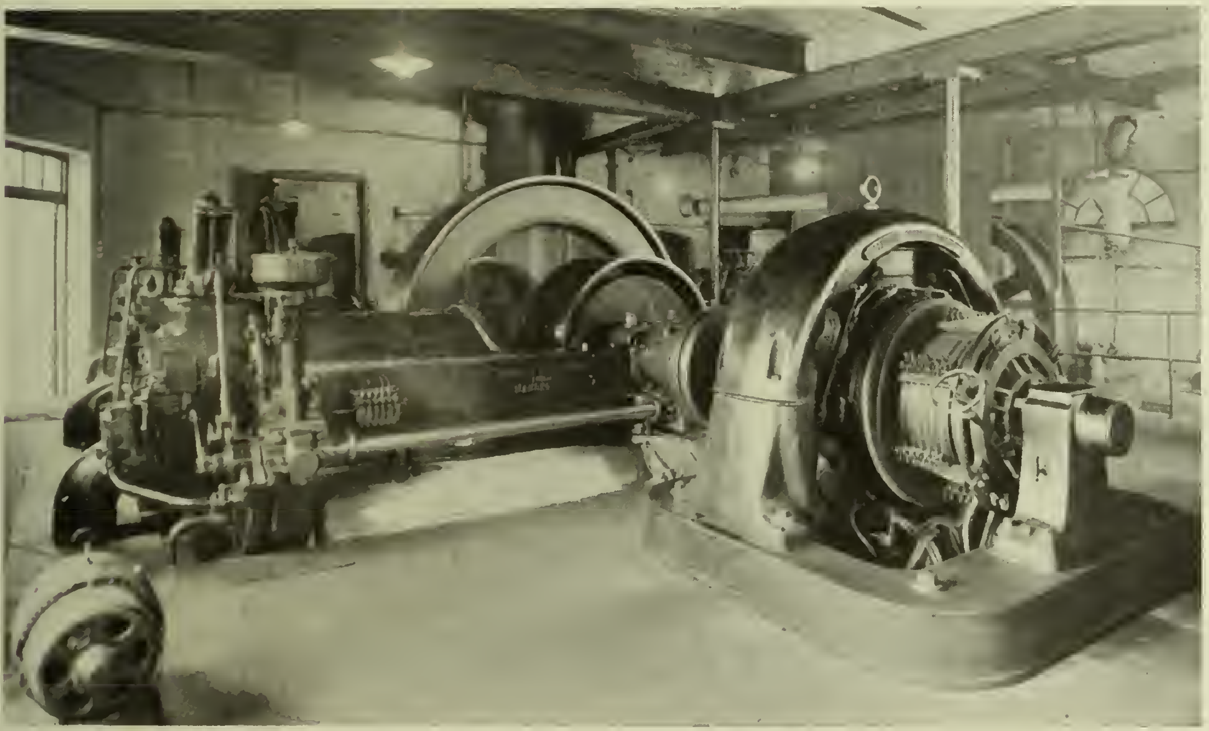

Crude Oil Engine. Made in Sizes from 40 to 130 h.p.

The great expansion of the business during the past fifteen years had necessitated several minor extensions to the works at Openshaw, but by 1914 the limit had been reached and it was evident that, to cope with the ever-growing demand, extensions on a larger scale must be undertaken. A suitable site was therefore chosen at Erwood Park, near Manchester, and a piece of open country comprising 48 acres was acquired, where new works were erected on the most modern lines. All further expansion was stopped, however, by the war, and Messrs. Crossley Brothers, Ltd., were one of the first private firms to be entrusted with Government contracts. This work, which was often of a strictly confidential nature, demanded throughout the very highest degree of accuracy, and the success with which it was in every case performed is further proof of Crossley workmanship and skill.

The return of peace conditions was the signal for the reorganisation and standardisation of conditions of manufacture, and the introduction of the most up-to-date methods and equipment has paved the way for the programme of mass production. Already the number of employees has reached nearly 4,000, and it is anticipated that when the extensions at Erwood Park have been completed the output will reach 200 engines per week.

Messrs. Crossley have further strengthened their position by the recent absorption of the Premier Gas-Engine Company. This company was one of the pioneers of large-power gas-engines in this country, and their large gas-engines are probably unequalled. Large extensions are already being made at their works at Sandiacre, Nottingham, and it has been decided to increase their output to four times its pre-war figure.

The acquisition of these branch works for the manufacture of large engines only will enable Messrs. Crossley Brothers, Ltd., to devote the entire output of their Openshaw and Erwood Park works to engines of small and medium size, and to effect considerable economy by the standardisation of a limited number of models.



Crossley's 200 b.h.p. Twin Cylinder Gas Engine direct-coupled to D.C. Generator. View taken while engine running, showing absence of vibration.

In addition to a large financial interest in the firm of Crossley Motors, Messrs. Crossley Brothers, Limited, have a large interest in the Saunderson "Universal" tractor. These tractors, one of which was illustrated in the last issue of this journal, have already earned for themselves an excellent name, and their successful performance at the recent trials at Lincoln has attracted much attention.

The pioneers of the manufacture of internal combustion engines in the past, Messrs. Crossley's history has been one of continual progress. With a total output of over 83,000 engines, a present range of sizes from 3 b.h.p., and with a share capital of £2,000,000, the firm can justly claim to be not only the leading, but also the largest manufacturers of this form of power.

Railless Electric Traction.—Under this heading a short article appeared in our August issue, from which it would appear that the particulars given were supplied by the recently-issued report of the Departmental Committee on Road Vehicles. In conveying this suggestion we were under a misapprehension, as the details were furnished by *The Electrical Review*, and our apologies are due to our contemporary for not having quoted the journal on that occasion.

MODERN ENGINEERING PRACTICE.

DEVELOPMENT IN NARROW-GAUGE RAILWAYS.

An ingenious form of loco-tractor for narrow-gauge railways has been designed by Mr. F. Dutton, Superintendent (Motor Transport) of the South African Railway Administration. It is described by Sir William Hoy, General Manager in the official *Journal of Industries*, and it is thought will greatly modify the transport problem in new countries. The guiding wheels of the tractor itself, as usual, run on the rails, but the driving wheels, fitted with solid rubber tyres, run on strips of road metal on either side of the rail track. It is claimed that for a given horse-power and weight the hauling power is four times as great as with ordinary locomotives. The rails do not need to be heavier than 16 lb. per yard, steep gradients and sharp curves are easily negotiated, and the line can be located with much greater disregard for the physical characteristics of the district traversed than in the case of an ordinary railway. There are a number of other advantages, such as the ease and cheapness with which short spurs to farms can be laid. It is estimated that at the present time a 2-ft. gauge loco-tractor line, with 20-lb. rails, could be laid for £2,216 per mile, including rolling stock and buildings, as compared with about double that sum for an ordinary 2-ft. gauge railway. A loco-tractor line 20 miles long would pay its way on a volume of traffic which would, in the case of an ordinary narrow-gauge line, involve a loss of £4,285 per annum. Successful tests have been carried out on an experimental track with curves as sharp as 37 ft. radius and gradients of 1 in 17 on the straight and 1 in 18 on a 100-ft. radius curve. Rails of 16 lb. with 6-lb. light steel sleepers were used. The loco-tractor itself weighs 4½ tons, has a 35-h.p. engine, and uses paraffin as fuel. After 2½ years' work the rubber tyres were in good condition. Generally speaking, Sir Wm. Hoy does not favour the use of narrow-gauge railways as feeders to and in connection with wider or standard-gauge lines. As separate entities, however, they have special advantages, and are of the most practical value in helping to solve transport problems in territory such as China, where other methods of transport are so deficient. In such cases, narrow-gauge lines should be regarded and worked rather as tramways than as railways, and as such they are of proved worth to industry.

OXYGEN ENRICHMENT OF AIR IN METALLURGICAL OPERATIONS.

The possibility of obtaining a material saving in coke consumption, with an increased pig-iron production by the use of additional oxygen in the air, has recently been made a matter of investigation by Mr. G. A. Meissner, chairman of the United States Steel Corporation's Committee on Blast Furnaces. Conclusions so far can only be based on theory, as there is no actual practice to go by, and only little experimental work. Ten per cent. additional oxygen in the air has usually been accepted as being most likely to show what benefits could be derived by oxygenating the air. The knowledge we have from past experiments would indicate that if 20, 30 or 40 per cent. oxygen enrichment were employed, the form of the blast furnace as well as its total equipment would have to be changed entirely. Most of the modern blast furnaces built on the best lines, with large hearths, steep angles and wide boshes, and equipped with ample stove capacity, will have a top temperature of the escaping gases of from 300 to 450 deg. Fah. To lower materially this temperature would apparently cause serious disadvantages in practice. It might even lead to a wet top caused by condensation of moisture from the escaping gases. The only real saving that the use of oxygen could effect would be to lower still more the top temperature by further concentration of heat in the combustion zone and in the hearth, and under modern conditions it is doubtful whether this saving will be appreciable in practice under such conditions. There is no question that a higher temperature of combustion will be obtained in the hearth of a furnace by burning the coke with oxygenated air, but it is a well-known fact that the temperature in the hearth is almost exclusively governed by the heat balance depending on the heat-producing and heat-consuming reactions. This temperature should not be permitted to vary much in order not to cause changes in the quality of the pig-iron, as the hearth temperature remains the same, while the amount of heat carried off by the gases leaving the hearth per unit of coke burned is less in proportion to the smaller amount of nitrogen in the blast. There should be more heat remaining available for the hearth reactions, and as there has been no greater heat demand created per unit of product, a decreased coke consumption should result. This, however, means a decrease in the amount of gases produced as compared with the former operation, and, therefore, a lower top temperature would inevitably result; and, as this lowering of the top temperature might seriously affect the operation of the furnace, it would soon become necessary to increase again the coke consumption until the lowering of the top temperature has passed the danger point. We can therefore hardly expect to add any material coke saving through the enrichment of the air with oxygen under such conditions. Where, however, we have furnaces operated with high top temperatures, such as those producing ferro-manganese, ferro-silicon, or those working with rich ores, or having high top temperatures on account of poor construction and equipment or other conditions, a certain definite gain can undoubtedly be expected. There could be no doubt as to the value of enriching air with oxygen for blast furnaces in an emergency. But then we have to consider the question of installation of such a plant as would give us cheap oxygen, and it would not be easy to arrange a plant for intermittent operation.

THE CASE FOR THE STEAM MOTOR WAGON.

For transporting a maximum tonnage over a maximum distance in minimum time at minimum cost, the steam-wagon takes an easy lead over its rivals. For maximum mobility with lighter loads for intermittent work, the petrol vehicle, and for town work, the electric vehicle, have undisputed claims. Results of lengthy tests recently carried out by Mr. P. W. Robson, and submitted by him to the Institution of Mechanical Engineers, showed that the average cost of hauling five tons over one mile with a steam vehicle was half the outlay incurred when employing petrol vehicles. Modern practice as regards design by leading makers of steam wagons may be considered as standardised in all main features. There are to-day three well-defined types of steam wagon. The over-type, where the engine is mounted on the boiler; the under-type, where the engine is quite separate from the boiler, and is fixed to the chassis under the body of the wagon; and the Clarkson type, with flash boiler and high-speed engine running in one direction only, reversing being effected through a gear-box. The over-type design makes the greatest bid for popularity on account of its accessibility, with corresponding reliability and ease of repair. If the permanent functions of road transport come to be regarded on the lines Mr. Robson suggested, the evolution of motor vehicles with a capacity up to 10 tons may be expected, and then these will certainly be steamers. At the other end of the scale his investigations have brought him to the conclusion that there is a wide field for a light mobile steamer of 3 tons capacity. It is, therefore, at the upper and lower limits of carrying capacity that there seems to be the most room for new ideas both in design and in manufacture.

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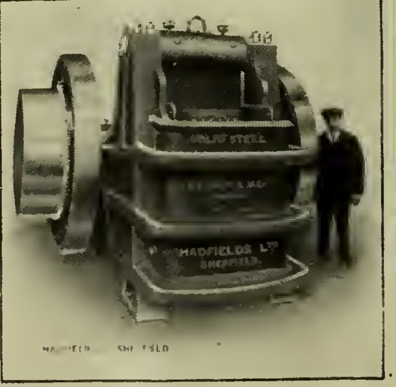

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NEW METHODS OF ROLLING LINEAL PRODUCTS.

An improved process of rolling lineal products, such as rails, blooms, bars, etc., has been instituted by Mr. C. A. Witter, of Philadelphia. By this method it is possible to produce products free from piping and segregation, the longitudinal core of the ingot, wherein are contained all the defects, being entirely eliminated from the finished material. At the same time the yield from the ingot is increased 15 to 20 per cent. While it is conceded that the piping itself can be largely eliminated with sufficient discard from the ingot, to ensure further the elimination of the segregation would require a still greater discard, making it commercially prohibitive. It was the idea of eliminating the core of the ingot from the cross section of the finished product that suggested the new process. By this method, after the ingot has been poured, it would be allowed to cool, then re-heated thoroughly in a continuous furnace: the re-heating accounts for the 3 per cent. loss: or, the hot ingots could be used as at present: but to ensure freedom from the oxidised top of the ingot appearing in any point of the rail, the author proposes to use a punch of larger diameter than the diameter of the ingot. This would slightly increase the percentage of loss in the punching, which would be offset, however, by the reduction in the heating loss to about 1½ per cent. The ingot is then placed under a 10,000-ton hydraulic press and bloomed to the desired width. A hole is punched in the bloom in the same operation, removing piping and segregation, and to the required size to permit the bloom being placed over the pressure roll of the blooming mill, which is of the same general type as used in rolling tyres. The bloom is then rolled to the necessary diameter, to give the required thickness. The only new operation consists in the cutting and straightening of the circular bloom. The straightened bloom goes direct to the finishing mill to produce the finished product. The time required for the forging, rolling, and straightening operations would not be any more than is required on modern rail mills for producing the final size of bloom before going through the first shaping pass. By this process there is accomplished in two operations what ordinarily requires the first eight to ten passes on a modern blooming mill, thereby making it practical to complete the forging and rolling operations in one heat, as at present. The process applies with equal advantage to the special requirements of the motor industry for alloy steels of the highest grade as used for crank-shafts, connecting rods, etc., also to tool steel as well as shell and other ordnance steel requirements.

PERSONALIA.

Mr. Henry Hobden, who is at present the Head of the China Section of the Overseas Organisation at the Federation of British Industries in London, and who during the war was in charge of the Far Eastern Section at the Department of Overseas Trade (Foreign Office and Board of Trade), is in the interests of the Federation shortly proceeding to China on a visit of some six months' duration.

Mr. A. Spencer, a director of the Metropolitan Carriage, Wagon and Finance Co., Ltd. (joint vice-chairman), Metropolitan-Vickers Electrical Co., Ltd., and George Spencer, Moulton and Co., Ltd., has been elected a director of Vickers, Ltd., to fill the position recently vacated by Mr. Dudley Docker.

Mr. G. O. Blacker, East Indies Commissioner for the Federation of British Industries, arrives in London at the end of this month, and will tour the industrial districts of Great Britain in the interests of Anglo-East Indian trade.

The death is announced of Mr. Henri Louis Joly, A.M.I.E.E., M.C.J.S., who was an active promoter of the electric vehicle and an authority on storage batteries. Mr. Joly was also an expert on Japanese art.

We regret to announce the death of Mr. John Taylor, M.I.M.M., M.I.C.E., F.G.S., for many years senior partner of the well-known firm of mining engineers, Messrs. John Taylor and Sons.

The death is announced of Mr. James Weir, who, in conjunction with his brother, founded the firm of G. and J. Weir, of Glasgow, from which business he retired many years ago.

Lord Pirrie has been elected a director of D. and W. Henderson and Co., Ltd., in place of the late Dr. John Inglis.

The gross value of the estate of the late Mr. H. R. Cameron, a director of Smith's Dock Co., Ltd., is £7,267.

A bust of Sir Henry Bessemer has been installed in the McKinley Memorial Building at Niles, Ohio, U.S.A.

Mr. R. S. Rowell has been elected a director of R. and W. Hawthorn, Leslie and Co., Ltd., Newcastle.

The late Mr. H. G. Bickerton Brindley left £29,560.

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TRADE NOTES.

In connection with the British Empire Exhibition, which is to be held in London in 1923, the Imperial Government have agreed to give a guarantee of £100,000 against any loss which may result. The Government contribution is subject to the following conditions:—(1) That the guarantees from other sources shall not be less than £500,000. (2) The Government to have the right to approve the choice of a general manager. (The appointment of Mr. Ulick Wintour, C.B., has been approved.) (3) The executive council of the exhibition to be enlarged and strengthened, the final list to be approved by the Board of Trade. (4) All regulations affecting the participation of the Dominions, India, the Colonies and Protectorates, and the entry of British exhibitors, to be approved by the Exhibitions Division of the Department of Overseas Trade. These conditions have been complied with.

The directors of the Leeds Forge Co., Ltd., propose increasing the capital to £1,250,000 by the creation of 180,000 new preference shares of £1 each and 400,000 new ordinary shares, ranking in each case *pari passu* with the existing shares. It is also proposed to write up the value of the land, buildings and other fixed assets from £301,212 to £561,212 and to carry to the reserve fund an additional £260,000 to answer such accretion to the value of the fixed assets. A resolution will be submitted that the £380,000 standing to credit of reserve be capitalised and distributed as follows:—£30,000 to preference shareholders in the proportion of one such share for every four now held; £350,000 to ordinary shareholders in the proportion of seven new shares for every three held.

The accounts of Guest, Keen and Nettlefolds, Ltd., show:—Profit, £860,509; brought forward, £235,686; interim preference dividend, 5 per cent. per annum; interim ordinary dividend, 10 per cent. per annum; final preference dividend, 5 per cent. per annum, free of tax, £43,000; final second preference dividend, 5 per cent. per annum, free of tax, £90,630; final ordinary dividend, 10 per cent. per annum, free of tax (making 10 per cent. for year), £244,543; bonus 1s. per share, free of tax, £244,543; carry forward, £261,604.

It is officially announced that the negotiations between the Directors of Stewarts and Lloyds, of Glasgow, and Alfred Hickman, iron and steel manufacturers, of Bilston, for the amalgamation of the two companies have been concluded. The combined capital of the two companies will amount to about 4¼ millions. Stewarts and Lloyds, Ltd., announce interim dividends, 6 per cent. per annum on preference and 10 per cent. per annum on preferred ordinary.

The directors of John Hetherington and Sons, Ltd., machine tool manufacturers and textile machinists, of Manchester, in announcing a dividend of 15 per cent., less tax, on the ordinary shares, outline proposals for the capitalisation of £115,000 out of undivided profits and reserve by the creation of 100,000 ordinary shares, restoring the ordinary share capital to its original amount. The proposals provide for an increase in the preference shares, at present standing at £8 paid up, to their original value.

A prospectus will shortly be issued offering £400,000 5½ per Cent. (free of income tax) First Mortgage Redeemable Debentures of Marshall, Sons and Co., engineers, of Gainsborough. The price of issue will be £95. The last balance sheet (Dec. 31, 1919) showed surplus net assets of £1,295,719 and the net profits for 1919 were £116,068.

The directors of W. T. Henley's Telegraph Works Co., Ltd., have declared a dividend on the preference shares at the rate of 4½ per cent. per annum, less income tax, for the half-year ended June 30 last; also an interim dividend on the ordinary shares of 1s. per share, less income tax.

Vickers, Ltd., have declared:—Interim dividends: 2½ per cent. on preferred 5 per cent. stock and 5 per cent. preference shares; 2½ per cent. (free of tax) on cumulative preference shares; interim dividend postponed.

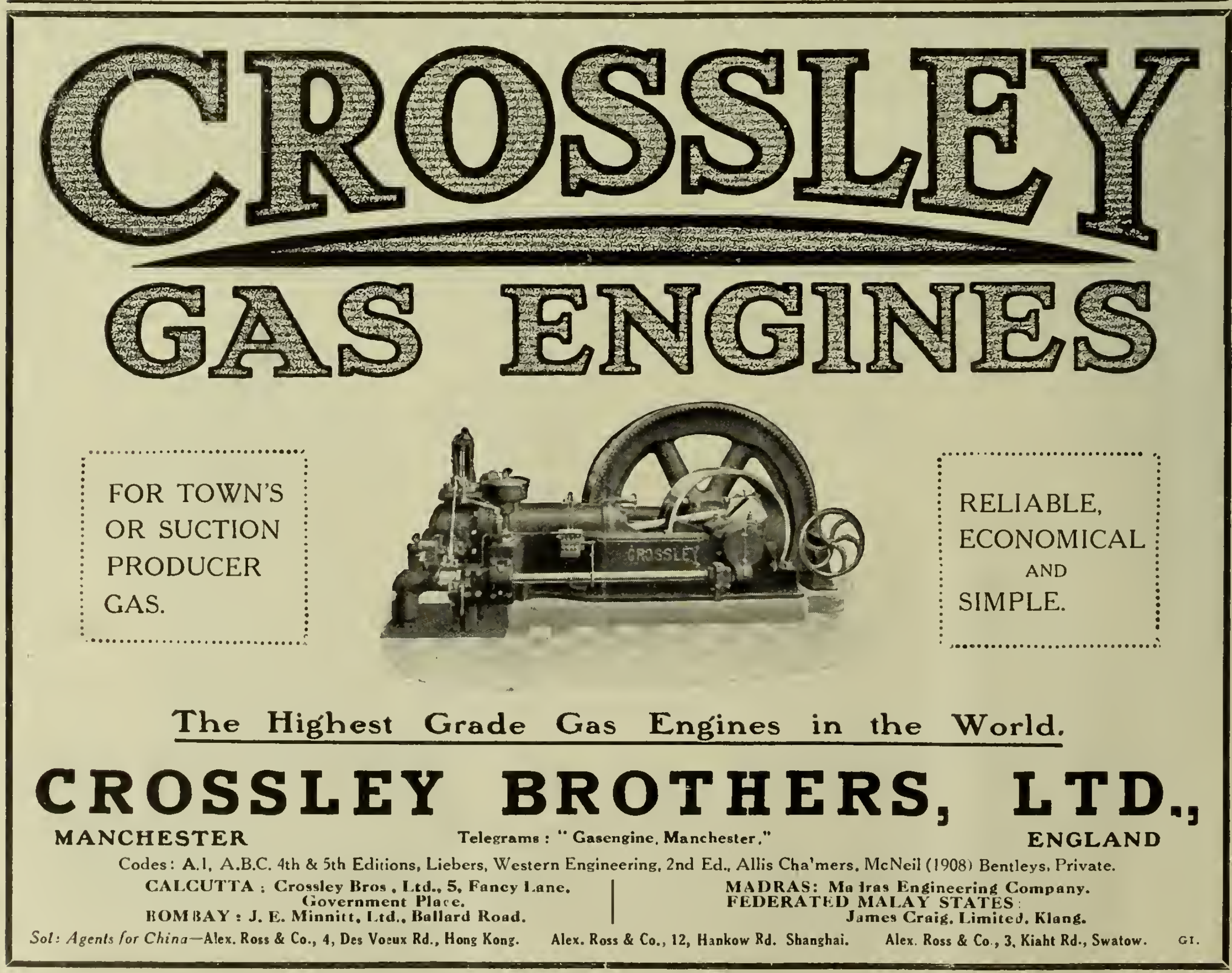
The directors of the Staveley Coal and Iron declare a final dividend of 1s. 6d. per share, fully paid, 1s. 1½d. per share, part paid, making 11¼ per cent. for year, tax free.

North British Locomotive.—An interim dividend is announced by this company of 2½ per cent. on preference, in respect of half-year ended June 30, less tax.

Swan, Hunter and Wigham Richardson, Ltd., of Wallsend-on-Tyne, have paid an ordinary interim dividend of 3 per cent., free of tax.

Crossley Brothers, Ltd., of Openshaw, are paying an ordinary dividend, 6 per cent. per annum, less tax, for half-year.

Bolckow, Vaughan and Co. pay a final ordinary dividend of 8 per cent., making 12 per cent. for the year, less tax.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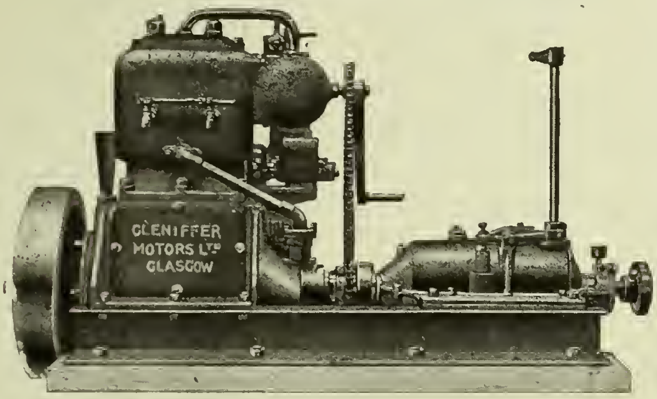

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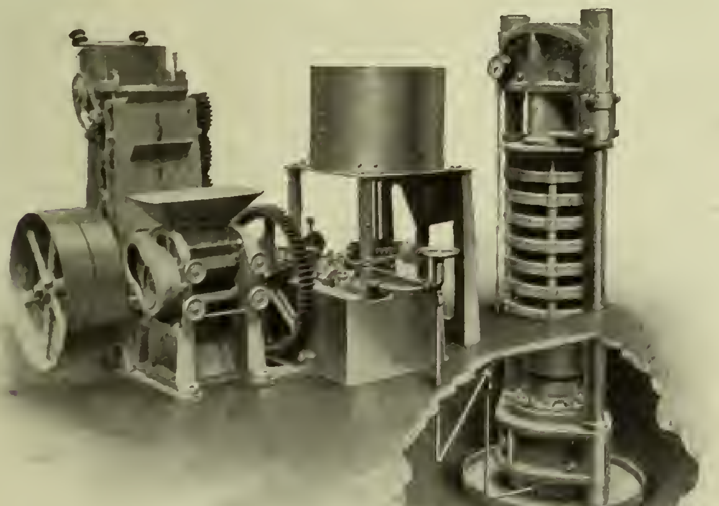

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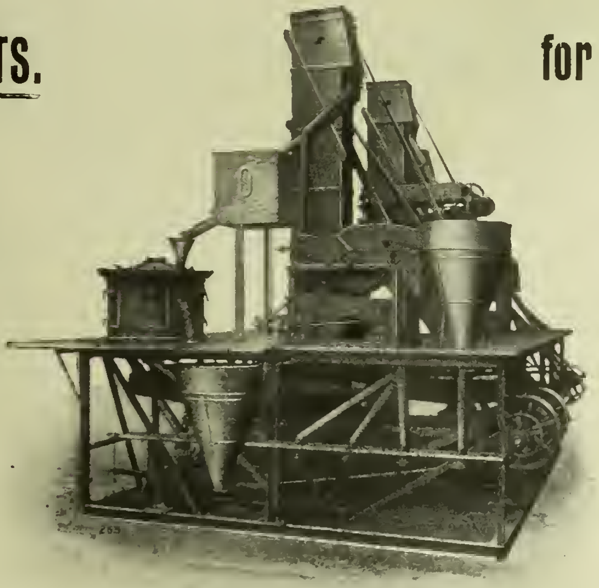

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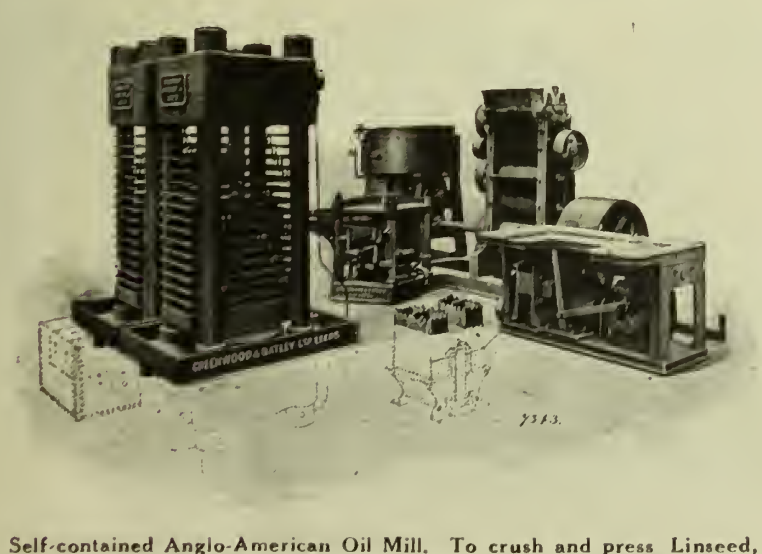

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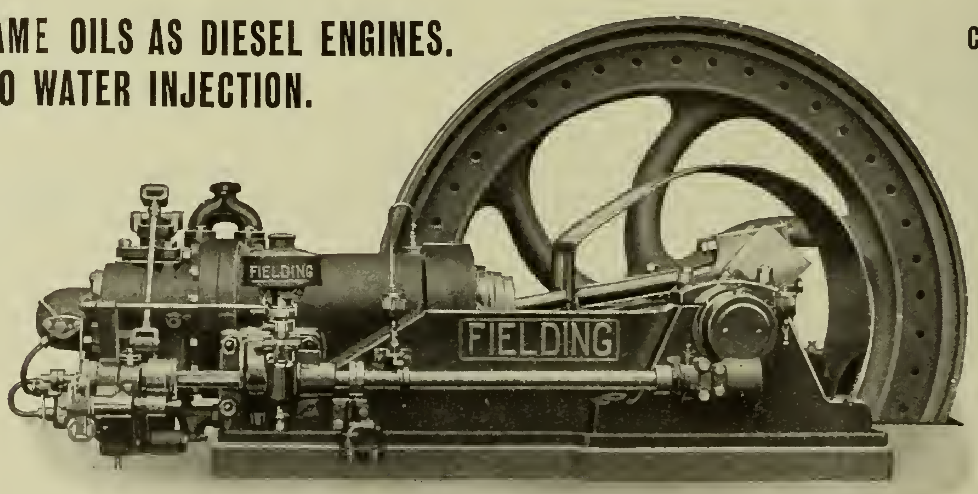

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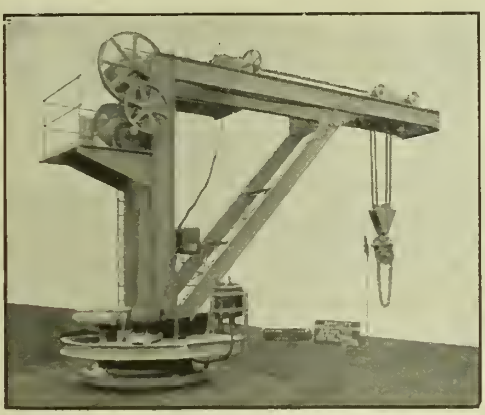

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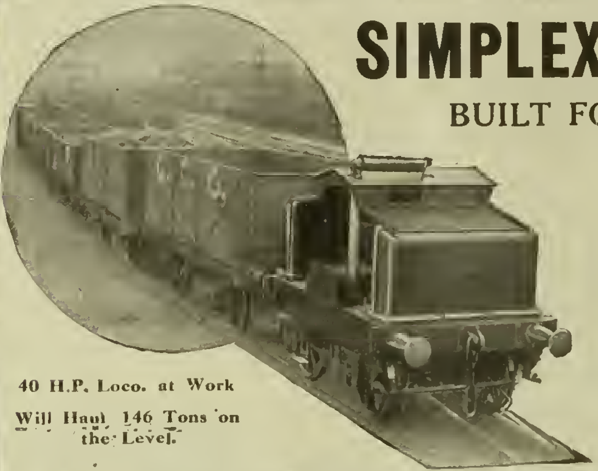

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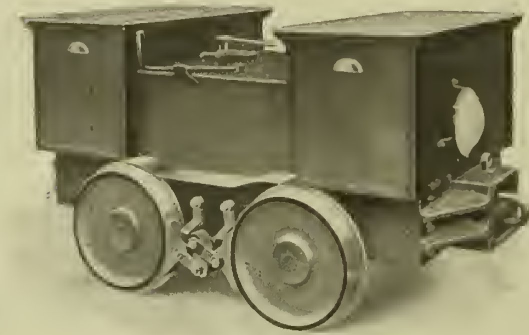

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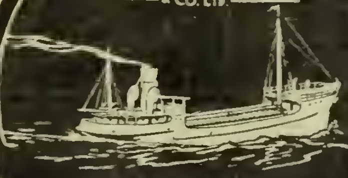

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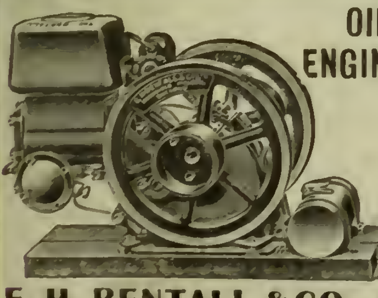

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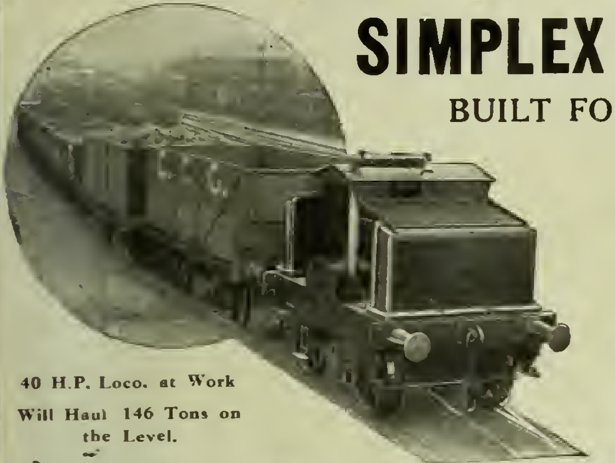

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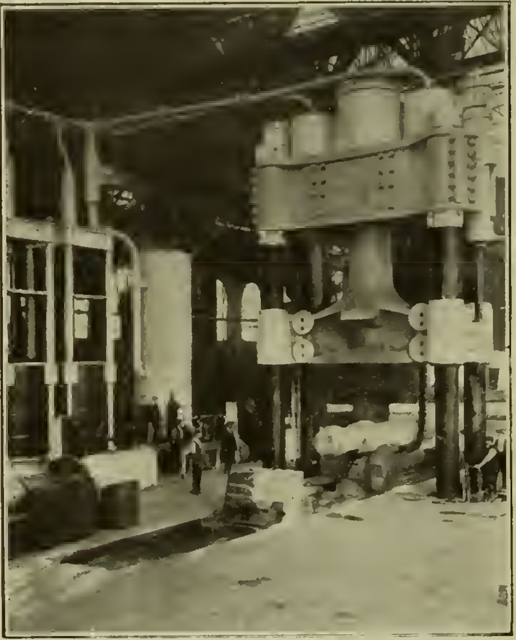

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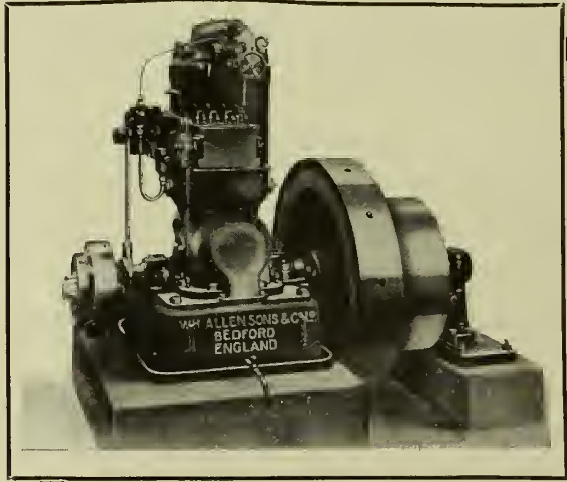

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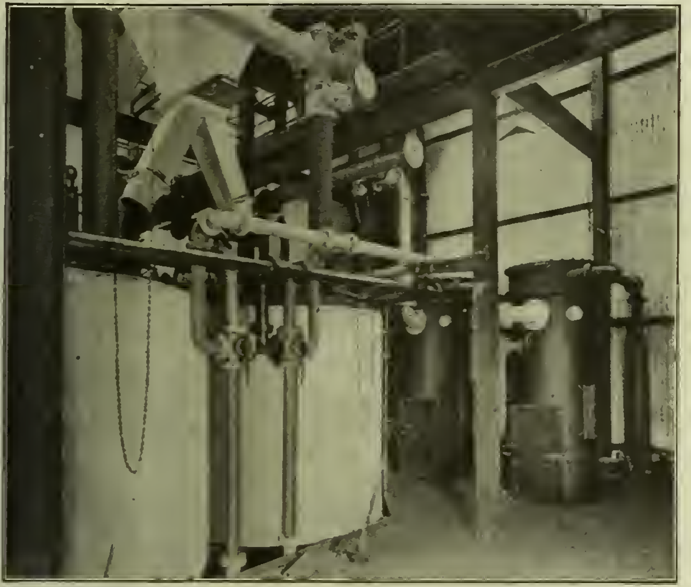

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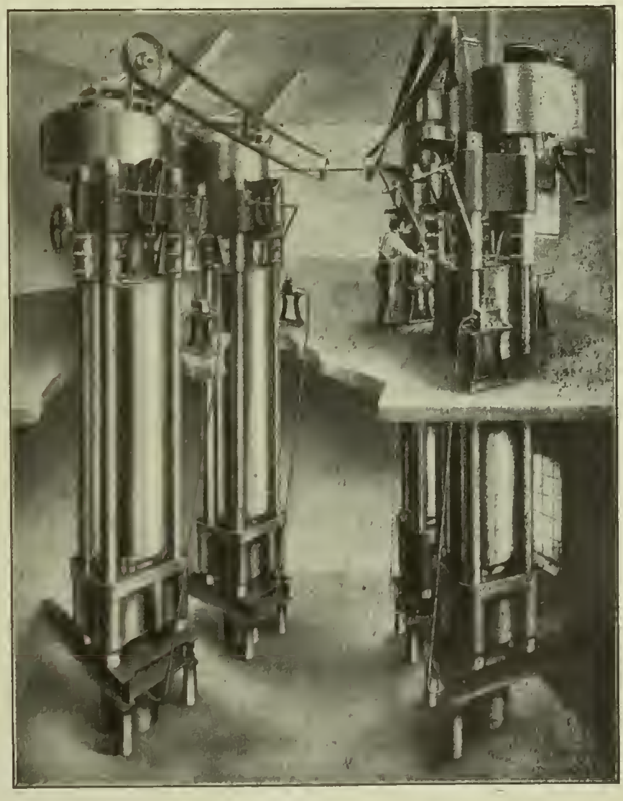

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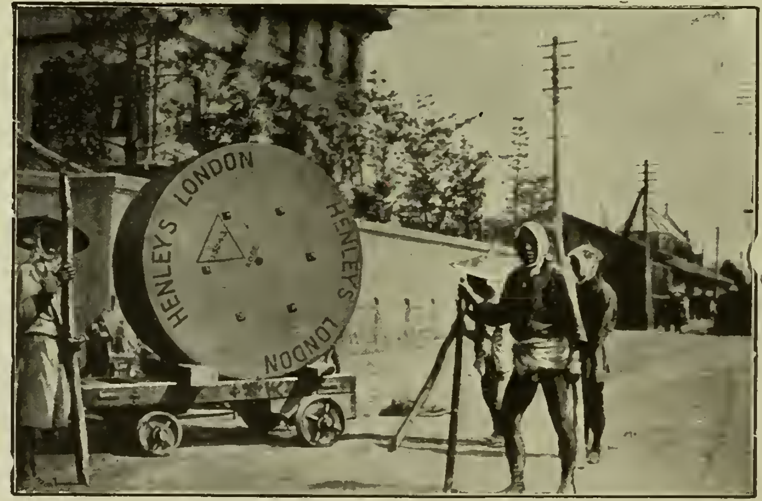

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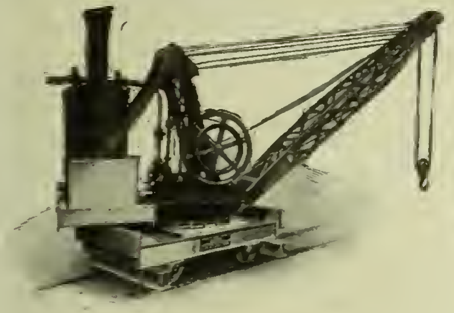

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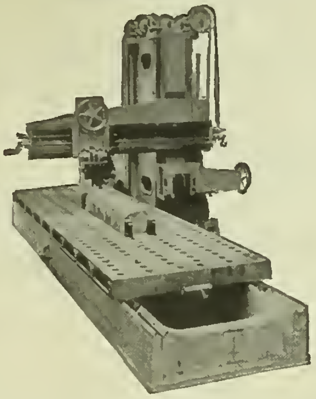

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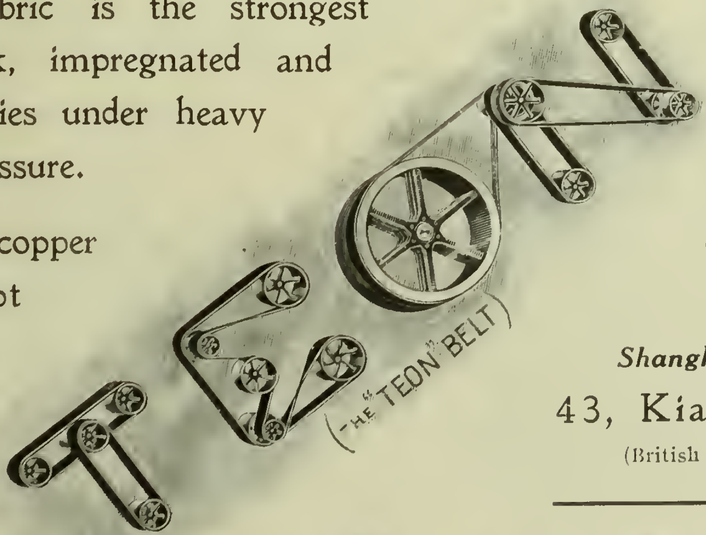

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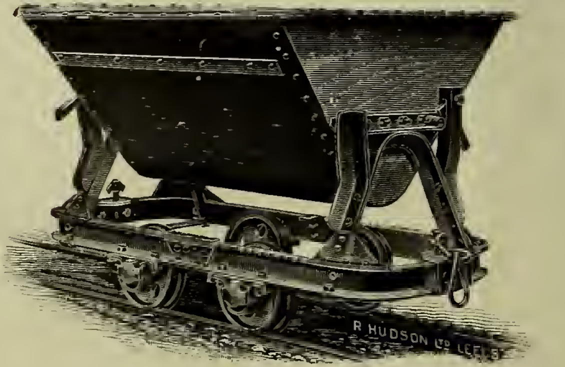

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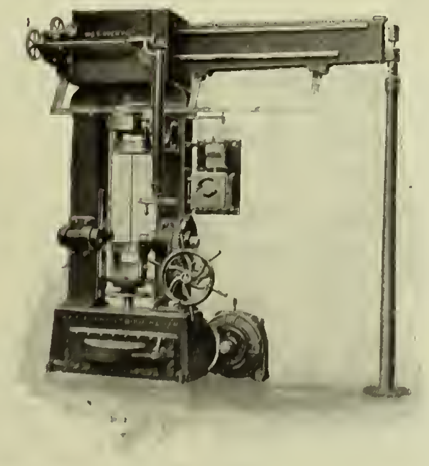

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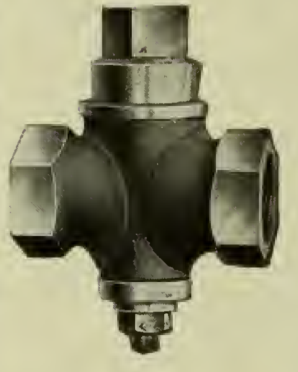

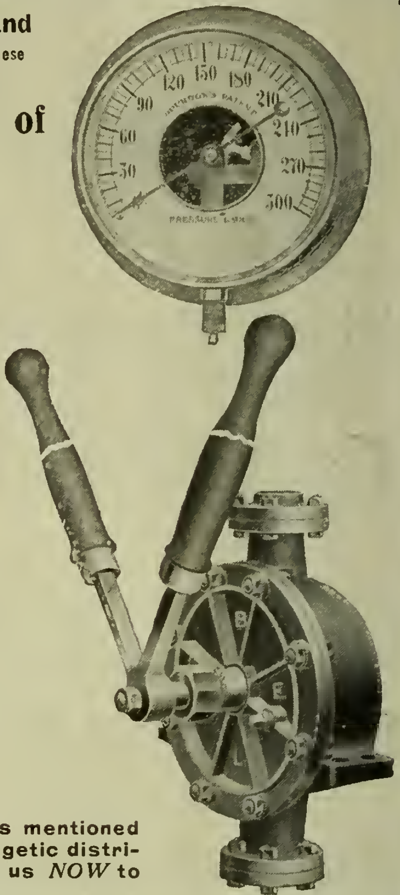

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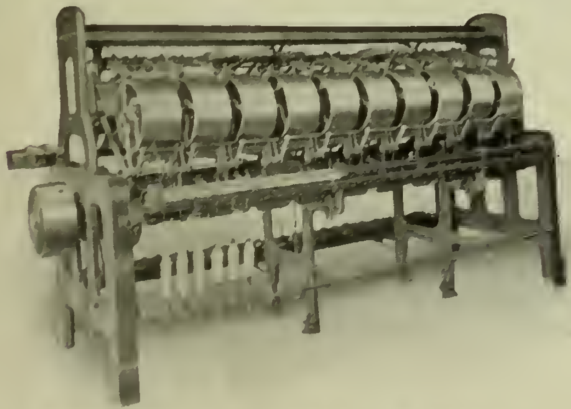

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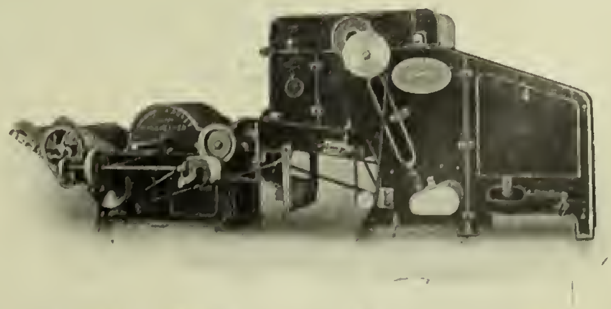

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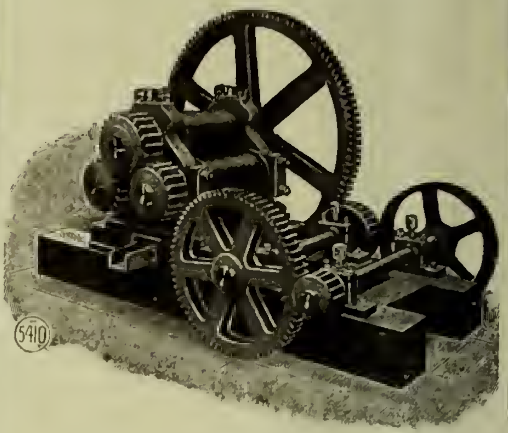

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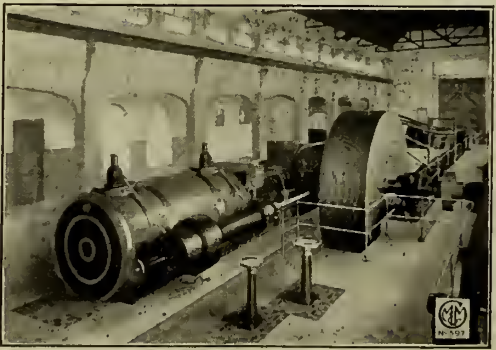

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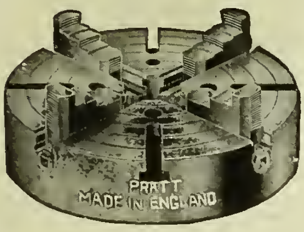

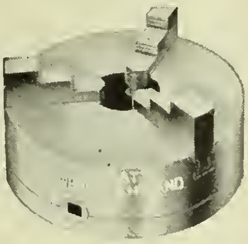

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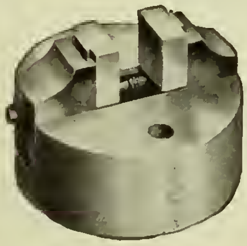

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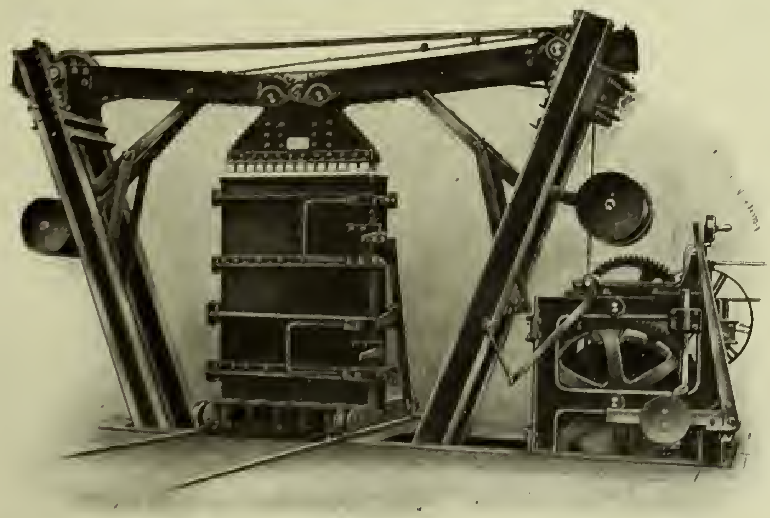

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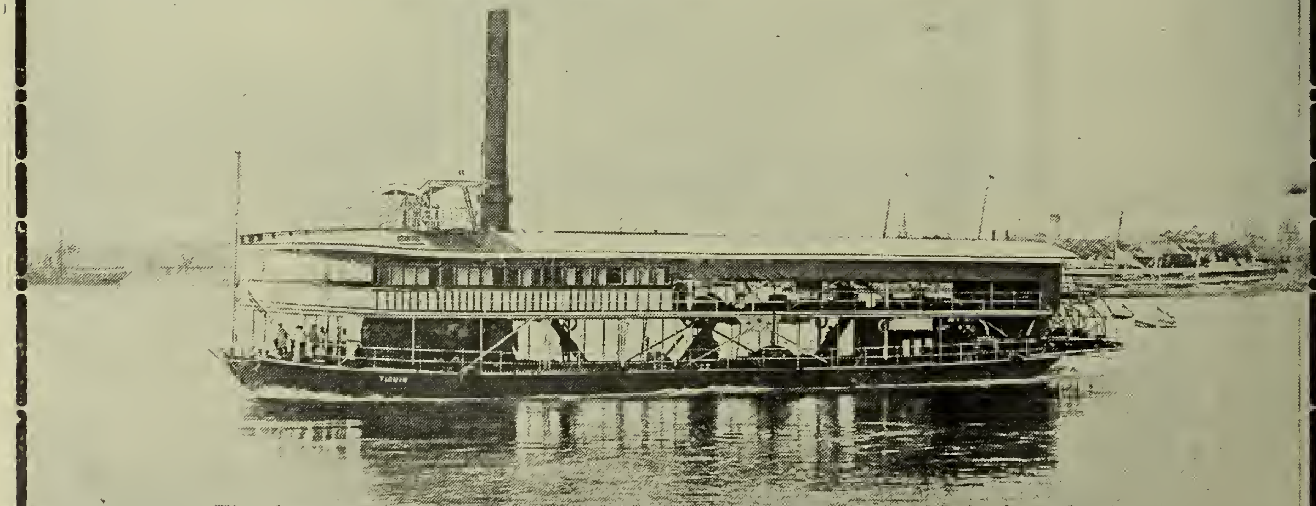

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EASTERN ENGINEERING

Vol. XI.—No. 10.] OCT. 7, 1920. [New Series.

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NOTES AND COMMENTS.

TRADE OUTLOOK IN GREAT BRITAIN.

For some months past fears have been entertained in Great Britain of a set-back in British commerce. Greater and lesser lights in industry have not hesitated to assert as much, and even the Federation of British Industries has seen fit to place its warning on record. No doubt such fears have had a chastening effect on labour troubles, and may to some extent have been created for this beneficial purpose, and with the object of indicating to the Government the evils to which industry is exposed by high taxation. It will be regrettable, however, if the prophecies so freely expressed concerning the outlook for British trade are allowed to prejudice the country's position and credit in foreign markets. Such forecasts are too largely founded on distorted facts, and they lack perspective. Only two years ago we were in the midst of war conditions. The first January after the termination of hostilities—that of 1919—saw the export trade of the country at little more than 40 per cent. of what it was in 1913, and this percentage crept up to 56.4 during that year. For the present twelve months the export trade has continued to increase. For the first quarter exports reached 75.38 per cent. of the total for the corresponding period of 1913, and, for the period April to June last, 79.68 per cent., whilst the figures for July amounted to between 80 and 90 per cent. of the total for July, 1913. Here, surely, is no cause for pessimism. Many difficulties have no doubt to be surmounted during the coming half-year, but, granted a fair measure of industrial peace, the outlook cannot justly be regarded as discouraging. The position in Great Britain, as in other industrial countries, calls for strenuous endeavour and the closer co-operation of all classes. Conditions could be stabilised, and difficulties mitigated, by what has been termed an "industrial armistice" for twelve or even six months. Compared with most countries, the position in Great Britain is relatively good, and fears of a trade set-back are certainly stimulating manufacturers to develop their foreign markets and to give greater attention to potentialities in the Far East. Indeed, from the very elements which are now said to foreshadow collapse, it would be an easy and a pleasant task to construct a forecast of prosperity and expansion. What is wanted now, however, above and before all, is reasoned and dispassionate judgment. It is to aid in some small degree towards this end, and to offset the amount of ill-judged publicity now given to our Jeremiahs in industry and commerce, that this note is written.

ANGLO-CHINESE INDUSTRIAL CO-OPERATION.

A good deal of congratulatory comment has recently centred around the Kiangnan Dock and Engineering Works at Shanghai. The recent launch of the steamship *Mandarin* at these works, and the fact that four similar vessels should have been under construction simultaneously in the same yard, is remarkable achievement enough. It marks, moreover, a triumph for British engineering influence working in conjunction with the Chinese and offers potent encouragement for such co-operation in the future. The Kiangnan Dockyard, as it now exists, was organised by Admiral Yeh, who had been educated and trained in the British Navy. Captain Woo was appointed a director. This gentleman also had Western experience, whilst the superintendent, Mr. R. Mauchan, had received his training on the Clyde. In developing the works, the European staff have received the co-operation of the Chinese Government officials. Much of the plant and equipment is of British manufacture or of British type. Two of the largest drilling machines installed are by British makers. The steel work required for the new boilershop has been ordered from Great Britain, and in the construction of the four vessels referred to above we understand that the entire technical staff is British, the vessels themselves being for America. Here, surely, we find an instance of international co-operation, and upon such lines development will best proceed in China, and such development will benefit not only China, but the world in general. The dockyard is run on commercial lines, and has enjoyed no special privileges from Government. It has had to justify its existence by results. The yard covers an area of sixty-six acres, and the new extensions will take up a considerable portion of the existing vacant space. The equipment is efficient and thoroughly up-to-date, as instance the installation of an electric steel furnace, the first of its kind in China.

CHINA'S INDUSTRIALISM.

The industrial development of China is at length being very generally realised by those in authority in industry and commerce outside the Far East. Such are getting China into correct perspective, and regarding her as producer as well as purchaser. Some of the most recent evidence in this connection is to be found in an article by Dr. Strewe in the *Technik und Wirtschaft*. On previous occasions we have had occasion to refer to statements by Dr. Strewe which have generally been of importance when directed to Far Eastern affairs. In the present instance the writer argues that the old opposition in China to Western innovations has disappeared, and, as a result of the cessation, on the outbreak of war, of the import of many European commodities to which she had grown accustomed, there has been instilled into the minds of the Chinese the advantages of home production of these commodities. Dr. Strewe gives credit to the Japanese for the bid for industrial development in China and Manchuria since the end of 1918. The success which has attended industrialisation in Japan, and the prosperity of industrial undertakings in China itself of late, have made Chinese owners of capital more ready to take risks, and have encouraged them to invest their money at home instead of, as formerly, in industries abroad. But sufficient capital will always be available for the development of industry in China, if only because of the enterprise of the Powers competing for trade in the country. America certainly is active and accommodating in this direction. China is wealthy in her agricultural resources, in cotton, coal, and minerals, and with all the prerequisites for speedy industrialisation, Dr. Strewe forecasts an expansion of unparalleled rapidity.

STANDARDISATION IN RAILWAY ELECTRIFICATION.

In a report just issued in London by the Departmental Committee of the Ministry of Transport it is unanimously recommended that the whole of the electrical equipment of British railways should be absolutely standardised. This recommendation is issued rather late in the day, as some of the harm which the recommendation is framed to prevent has already occurred. Still, to-day the question of standardisation in railway electrification is one of first importance to every country where there is a future before this method of transport. In the Far East the outlook before electric traction is unquestioned, and progress will be hindered if the haphazard methods so long followed on steam railways are followed in electrical operation. The advantages of standardisation not only ensure the through running over systems in different ownerships, but they substantially reduce manufacturing costs by allowing the manufacture of equipment to be undertaken on mass production lines. Varying structure gauges and difference in the carrying capacity of bridges present difficulties, but in the standardisation of smaller matters and in the equipment necessary for electrical operation no great impediments should stand in the way. If standardisation makes headway in the Far East, then it becomes essential that manufacturing concerns in Great Britain should be prepared to manufacture to such standards. Moreover, endeavours should be made, wherever possible, that British standard equipment should be installed.

COPRA AND COCONUT OIL.

Recent statistics from consuming centres clearly point to the fact that the demand for copra and coconut oil is rapidly increasing. The increase, moreover, is likely to be very much more marked when Germany and Russia again enter the market. In these circumstances, it is to be sincerely hoped that all advisable measures will be taken to develop production of such commodities in the Far East, and to hasten forward the schemes already in hand for increased planting. It is difficult to see that any sound basis exists for the fear of over-production, particularly as production costs are capable of being materially reduced by adoption of improved and labour-saving methods of cultivation, and by the use of modern equipment in handling and preparing the product. Exports of copra from British Malaya in 1919 were 115,629 tons. The establishment of further oil mills in the country is being negotiated, and Government assistance has been offered. A great increase in exports of coconut oil from the Philippines has taken place during the last few years. From 12,000 metric tons in 1914 the shipments increased to 45,198 metric tons in 1917, practically all to the United States. No corresponding decrease in shipments of copra took place, as might have been expected; on the contrary, copra exports increased from 87,344 metric tons in 1914 to 92,180 metric tons in 1917. Copra crushing on a large scale is being developed in Southern India, and exports from the countries of tropical America are important. The principal countries of the British Empire which export copra are Ceylon, Malaya, Fiji, the Tongan Islands, the Solomon Islands, and the Gilbert and Ellice Islands, Zanzibar, and East Africa, Seychelles, Papua, the Gold Coast, and Trinidad. Ceylon and India also export large quantities of coconut oil. The chief foreign countries exporting copra are the Philippines, the Dutch East Indies, Samoa, French Oceania and New Caledonia, French Indo-China, and Portuguese East Africa. It is certain that if development does not proceed in the Far East, supplies will be forthcoming elsewhere.

THE PATHOLOGY OF INDUSTRIAL UNREST.

Even a decade ago it would have appeared unusual to find in a journal specialising, as this journal does, on engineering in the Far East, rather extended reference to labour troubles in Great Britain. The position, however, to-day in the Far East renders such a reference highly desirable, for industrial development in this part of the world is proceeding apace, and labour difficulties are already assuming appreciable proportions. The Far East has, perhaps, as much to learn from other countries in dealing with such problems as it has in technical matters affecting industry. Study of the experiences through which other countries are passing may render it easier for the Far East to tread the thorny path of industrial unrest. In these circumstances, it seems worth while to mention that we have received from the British Engineers' Association a copy of a little brochure by the Director of the Association, Mr. D. A. Bremner, O.B.E., entitled "The Pathology of Industrial Unrest, with Some Special Reference to the Engineering Industry." It is an eight-page pamphlet, the contents of which can be mastered in a brief interval of time, and it represents one of the most valued contributions to similar literature that we have met with. Mr. Bremner first reviews the abnormal and artificial conditions in which industry has been placed during and since the war, and the economically unsound practices which hve developed. He defines the disease of industrial unrest as the acute inflammation of labour's innate feeling of dissatisfaction with the distribution of the product of industry, the gradation of human society, and its own status therein. This is complicated by popular ignorance of the economic laws governing the material well-being of a community, and of the forces determining the structure of human society, rendering some degree of stratification inevitable. Moreover, the disease has been complicated by the fact that natural and legitimate feelings of dissatisfaction have been basely exploited for political ends. The symptoms and effects of the disease are set out and will be well known, and then the theraputics of the case are studied. The disease is diagnosed as a morbid state of feeling, an emotion and affection of the mind. Two main remedial measures are suggested—an appeal to reason, or the creation of another feeling potent enough to overpower the one it is sought to subjugate, and replace it as a motive of thought and action. Thus dissatisfaction with a state of comparative well-being, such as is enjoyed by labour to-day, may be destroyed by the fear of losing it; contemptuous defiance of the under-estimated danger of industrial disaster may be converted into a fearsome prudence by the revelation of its real nature; disinclination to work may be overcome by love for one's dependants, or by the natural fear of bodily privation. Mr. Bremner urges the development of the various activities now in progress for educating all classes in industrial and national economics, and in combating the pernicious teachings of labour extremists. Causes for legitimate discontent should be promptly and voluntarily removed, and the more complete organisation of employees is strongly urged in carrying out these measures. The value of even a brief interval of industrial peace is forcibly emphasised. Thereby conditions will be stabilised, and the observed effects of industrial peace and increased production on the national economy and the general well-being of the people, should very materially ease the situation. Mr. Bremner's reasoning is creative, skilful, and eminently fair to all classes. The last words of the pamphlet read: "Prompt, decisive action is imperative." Happily, as director of the British Engineers' Association, Mr. Bremner should have the means of bringing his proposals to fruition with eminent benefit to industry.

ENGINEERING, MINING AND INDUSTRIAL PROJECTS IN THE FAR EAST.

HARBOUR IMPROVEMENTS IN JAPAN.

Plans for the extensions of harbours in Japan include:—

Yokohama ("3rd period extension" scheme).—The following are the principal details:—Area to be reclaimed, 397,000 square yards; length of new quays, 8,000 ft.; number of vessels to be moored, 12 (from 5,000 to 50,000 tons gross), to total gross tonnage of 150,000. A new road is also to be constructed, 90 ft. wide, connecting the main road between Tokyo and Yokohama with the new quays. The 4th period extension scheme includes construction of quays, of total length 15,240 ft., to accommodate 19 vessels. This scheme will not be put in hand till the 3rd period scheme is completed.

Kobé.—Considerable extensions have been completed The harbour has now an area of 12,000,000 square yards, with a depth of 36 ft. at low water, except where shallow near the shore. Four piers have been completed, each of a length between 1,290 and 1,200 ft. A new breakwater to the east has been practically completed, and another to the south, 1,000 yards in length, is under construction. Additions to accommodation recently completed amounted to over 68,000 square yards, two miles of roadway, and 716 chains of railway track have also been completed.

Moji.—Scheme for harbour improvement to extend from 1919-1926, at a cost of 5,250,000 yen, approved. The principal feature of these improvements is the construction of a quay 4,350 ft. in length, with a depth alongside of 33 ft. To obviate present difficulties caused by the rapid tide through the Shimonoseki Strait and the exposure of the harbour to north-west winds, improvements are also contemplated at Shimonoseki, but no details have yet been made public.

Further schemes are contemplated at Hakata and Kokura, in North Kyushu, in order to admit of the entry of ocean-going vessels—an improvement which will do much to assist this growing industrial district.

Work of improvement has been going on at the principal ports in the Hokkaido. A breakwater 3,000 ft. at south end of Hakodate Harbour was commenced in 1912 and completed in 1918, at a cost of 1,340,000 yen. Two breakwaters on north and south side of Otaru Harbour, which, when complete, will be 5,650 ft. in case of former and 6,076 ft. in latter. Considerable reclamations are also commencing. At Muroran, two breakwaters are under construction: the south 1,830 ft. and the north 3,200 ft. Dredging and reclaiming are in progress on south shore. Kushiro breakwater, 4,500 ft., now under construction on south side harbour. A further breakwater on north side is contemplated, and, on completion, the port will have a protected area of 1,680,000 square yards.

GOVERNMENT AID FOR THE SILK INDUSTRY.

Advices from Tokyo states that the Government has decided to advance 50,000,000 yen to the syndicate of growers, reelers, and exporters. The object of this advance, according to the Minister of Agriculture, is to maintain the price of silk at 1,500 yen per hundred kin, whilst reducing the export by half and restricting production if necessary. The Government will take the stocks off the hands of all firms in financial difficulties.

SOUTH HAMKYENG (KOREA) HYDRO-ELECTRIC SCHEME.

Further details are now available of the large hydro-electric power scheme contemplated for utilising the waters of the River Hwangsu-won, a tributary of the River Yalu in South Hamkyeng (Kankyo) Province, Korea. The project is backed by the Oriental Development Company, and the capital to be raised is 10,000,000 yen. The Province of South Hamkyeng is rich in timber and minerals, and it is anticipated that there will be a large demand for electrical power. It is calculated that the installation will take three years to complete. The principal items of expenditure will be the power station, 3,153,850 yen; transmission plant, 975,000 yen; and distribution plant, 366,435 yen. It is understood that the scheme has been approved by the authorities of the Government-General.

ROAD CONSTRUCTION BETWEEN CHEFOO AND WEHSIEN.

Owing to the difficulties in the way of bringing the Chefoo-Wehsien railway scheme to fruition, a proposal has been submitted and is being strongly supported for the construction of a motor car road between the two cities.

POSITION OF HARBOUR IMPROVEMENT SCHEME AT SHANGHAI.

It will be remembered that about two years ago a report was presented to the International Commission for River Works at Shanghai jointly by Captain Hugo von Heidenstam and the hydraulic department. The report expressed the opinion that it was necessary to increase the depth of the water at the port from 26½ ft. to 30 ft. to a depth of from 33 to 43 ft. The choice stands between an improvement of the entrance through the mouth of the Yangtsze River on the one hand and on the other the construction of a new deep harbour in connection with Shanghai farther to the south.

The International Commission approved the proposal in the report concerning further investigation, and voted a sum of *Tls.* 350,000 for the undertaking of a special examination of the technical possibilities of developing the port in a world's port. The investigation is now being carried out by a special department which, after consultation with harbour experts in London and New York on certain questions, is to present a scheme for alternative solutions, while the hydraulic department will also submit a separate scheme. A final decision on the question is to be reached in the autumn of 1921, when a technical commission composed of one representative of China and one each in the case of the five Great Powers interested in Chinese shipping will meet at Shanghai for this purpose.

RECENT DEVELOPMENTS AT CANTON.

A factory for manufacturing rubber goods has recently been successfully organised in Honam, Canton. It is understood that the manufactory is ordering raw products from Kiung-chow and Ngaichow, in the island of Hainan, where rubber trees are growing satisfactorily.

Ten thousand dollars has been appropriated by the Civil Governor of Canton as part of the Government's contribution towards a modern fire brigade.

Motor-busses for the Kwangtung Tramway Company have arrived from America, and are being assembled for service by a local firm of foreign educated Chinese engineers.

A new bank has been opened in Canton under the name of the Kwangtung Provincial Bank. Its capital is stated to be $5,000,000, and it is understood that it has more than two millions in silver on hand to start business. The Kwangtung Provincial Bank is a semi-Government bank, the Government subscribing two million, and the public three million dollars.

PROJECT TO ADVANCE COMMERCIAL AVIATION IN CHINA.

Mr. Thomas A. Barson, chairman of the Peking Syndicate, in addressing the recent annual general meeting, stated that in his opinion commercial aviation in China offered a large field for Brtish manufacturers, the development of which would offer the greatest assistance to the Chinese. The Syndicate holds the Handley Page agency, which can be much improved by the formation of a separate company co-operating with the Chinese to be managed in China. Such a company is in course of formation and will have sufficient capital to carry on its business even to the extent of financing Government and local enterprise. Mr. Barson is now on his return journey to China to take charge of this company.

PROPOSED NEW DOCK IN THE PRAI RIVER PENANG.

The consulting engineers have been instructed to prepare a preliminary report and to submit plans and estimates of the proposed new dock to be constructed in the Prai River. To provide for the future development of the port it is considered that a much larger dock than the existing one is required and the dimensions proposed are:—Length 450 ft.; width, 60 ft.; depth of water over the sill at low water, 21 ft. A slipway should be provided in addition for the repair of smaller craft. A considerable quantity of dredging would be necessary to obtain the requisite depth of water, the material recovered being utilised to reclaim the mangrove area on the south side of the river, recently purchased from the Prai Syndicate. The plan offers an admirable site for the establishment of a dockyard capable of dealing with the repairs to vessels up to 6,000 gross tonnage. Accurate estimates of the cost of these works are not available yet.

IMPROVED STEAMSHIP SERVICE BETWEEN VANCOUVER AND THE FAR EAST.

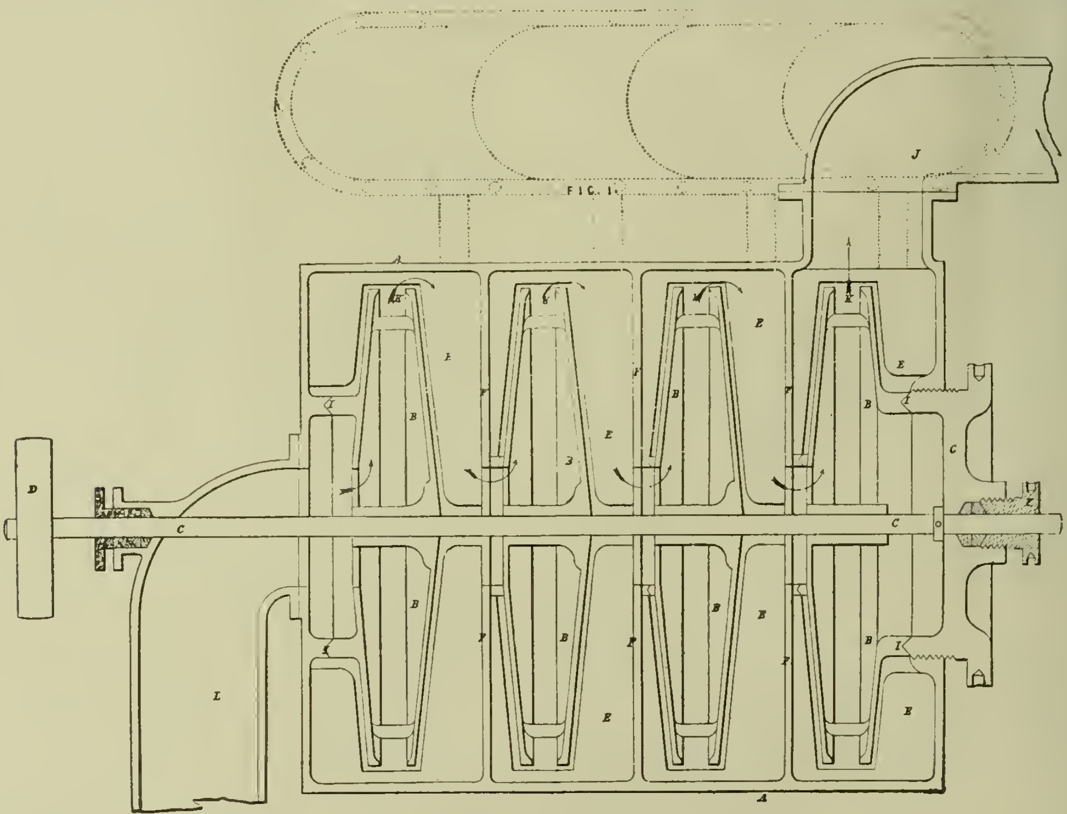
An agreement has recently been concluded between Messrs. Alfred Holt and Co. (managers of the Blue Funnel Line), the Canadian Government Merchant Marine, Ltd., and the Canadian National Railways for a joint steamship service between Vancouver and the Far East, each steamship interest to provide an equal number of vessels for the new service. In accordance with the agreement the Canadian National Railways and the Canadian Government Merchant Marine, Ltd., will be represented in the Far East by Messrs. Butterfield and Swire, the agents for the Holt interests, so that the Canadian undertakings will secure the advantage of an old and powerful organisation.

NEW NORTH BORNEO STATE BANK.

It is announced that a new bank, known as the North Borneo State Bank, is to be established. Offices will be opened in Sandakar and Jesselton as soon as arrangements can be made.

LARGE SUMS FOR AGRICULTURAL DEVELOPMENT IN DUTCH EAST INDIES.

Statistics from the Dutch East Indies show that for 1920 the expenditure has been estimated at fl.617,000,000, of which fl.247,000,000 goes to agriculture, commerce, and industry, public works and Government concerns. The influence of this greater activity of the State on the chief products, rice and sugar, is clearly perceptible. If irrigation works are considerably extended and the cultivation of the sawahs is energetically taken in hand, the Dutch East Indies, instead of importing the surplus of other tropical countries, will be able to export 5,000,000 tons of rice annually. In Java, the installation of water-reservoirs can, within a very short time, result in a considerable increase in rice production.



Reproduction of Illustration from John Gwynne's Patent of 1851, referred to in article on opposite page.

RICE STRAW AS MATERIAL IN THE PAPER INDUSTRY.

A combine of Dutch paper manufacturers proposes to establish a factory in Netherlands India, using rice straw as raw material. They have succeeded in making excellent writing paper from this material.

MACHINERY REQUIREMENTS OF NETHERLANDS EAST INDIES.

Official reports on the requirements of the Netherlands East Indies recently forwarded to the Foreign Office at Stockholm indicate a great demand for wrought iron, while there is every indication that the demand for cast iron and steel is likely to rise considerably. Sumatra may well become an important purchaser of iron and steel products, motors, tools, agricultural implements, girders, dynamos, railway material, etc. In general there is a great opportunity for exports to Insulinde and particularly for motors, telephone and telegraph material, bridge-building material, mining machinery, and machinery in general.

MOTOR TRANSPORT FOR TIMBER.

Motor lorries have recently been introduced into the Netherlands East Indies for the transport of timber with very beneficial results. The good prices obtained for timber have rendered this development possible and have enabled the economies and dispatch this method of transport affords to be put to practical test. A much larger demand for timber is anticipated, and presumably the Forestry Department are preparing to meet it. It is more than probable that the motor transport will shortly be adopted in other districts, notably the virgin forest districts of West and East Java, and that even when the price of timber suffers a decline the power wagon will still show a saving in charges due to increased hauling output.

INCREASED TERMINAL FACILITIES AT MANILA.

The Pacific Mail Co. is taking steps to build its own terminal at Manila furnished with modern equipment. Negotiations are understood to have been concluded recently with the Philippine Government whereby the steamship company will construct a private pier for its use in the harbour four times as large as any existing pier at the port. This decision marks a step forward in the scheme to make Manila a great distributing centre in the Far East. Very much more remains to be achieved, however, before the overcrowded condition of the port is relieved. A well-thought out project to provide additional terminal facilities with modern cargo-handling equipment would certainly receive the support of the Manila Merchants' Association and other commercial interests at the port.

TRANSPORT FACILITIES FOR NETHERLANDS INDIA.

A concession is being sought to construct a line to Kota Pinang and Panei in the Asahan district (east coast of Sumatra). The present intention is to lay the line as far as Marban, 92 kilometres from the starting-point between Kisaran and Tandj. The total length of the projected line is about 150 kilometres. Those concerned have abandoned for the time being the construction of a line from Pematang Siantar to Perapat, on Lake Toba. The Sibolga-Baligé motor service *viâ* Perapat to Pematang Siantar will probably be carried out in 1921. The Lake Toba boat service will probably be linked up with the railway from Perapat and the motor service.

GWYNNES, LTD.

THE ORIGIN AND DEVELOPMENT OF CENTRIFUGAL PUMPING MACHINERY.

On several occasions articles have been published in this journal dealing with the manufacturing facilities and personnel of leading British engineering concerns. Most firms so treated have been closely identified with certain classes of machinery. Such connection is particularly apparent in the present article dealing with Messrs. Gwynnes, Ltd., of London, a name associated by engineers throughout the world with centrifugal pumping machinery. The firm state, and with justification, that the story of their firm is so bound up with that of the centrifugal pump that the history of the one is practically the history of the other.

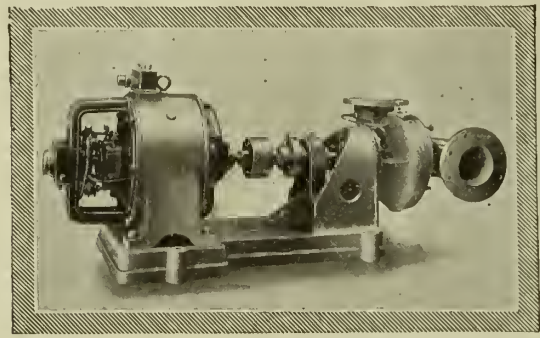
One of fifteen Machine Bays at Messrs. Gwynnes Works showing groups of Herbert Lathes.

The first centrifugal pumps to be made successfully in England were made in 1849 by John Gwynne and his son, J. E. A. Gwynne, who were respectively grandfather and father of the present managing director. The experiments made by John Gwynne, the founder of the firm, with his brother, enabled many improvements to be introduced into the design of the centrifugal pump. He evidently foresaw great possibilities for the machine in the future, as in 1851 he took out a patent which covered thirty different claims in connection with the designing of pumps. An illustration from the patent accompanies this article, and reference to this and the document shows that the patent anticipated the improvements introduced in centrifugal pumps since that date. The inability to work this compound pump at the period of the patent was due to the absence of means for obtaining the high speed necessary. Upon the introduction of the electric motor, however, Mr. Gwynne's ideas were developed and pumps are made now by the company to work against heads of 2,000 ft. and over. In addition to centrifugal pumps, the firm then held master patents for other machinery, such as the Gerrard Water Turbines, Gwynne & Beal Gas Exhausters, etc. The Gas Exhausters were supplied to the principal gas works throughout the country, including those at Beckton and Liverpool, where the gas was delivered a distance of six miles.

John and Henry Gwynne, brothers of James, who were connected with the original firm up to the year 1867, with works at Brook-street and Leather-lane, Holborn, then founded the Hammersmith Iron Works as a separate concern, where the manufacture of the "Invincible" Centrifugal pumping machinery is at present carried on. The junior partner lived only a few years, and the concern was then carried on under the sole direction of John Gwynne, now deceased. In 1878 the latter gentleman designed and patented the "Invincible" pump, which has obtained for itself a world-wide reputation. In 1897 John and Henry Gwynne was incorporated as J. and H. Gwynne, Ltd., and in the year 1903 the original firm of Gwynne and Co. was amalgamated with J. and H. Gwynne, Ltd., and the Brook-street Works was transferred to Hammersmith. Consequently, after working separately for 36 years, the two works once more became united under the title of Gwynnes, Ltd., under the chairmanship of Mr. John Gwynne, the directors being Messrs. J. G. Mair-Rumley, Henry Marshall and Nevile G. Gwynne, the latter now being managing director. The site of the Hammersmith works is on the Thames near the Hammersmith Bridge, and com-

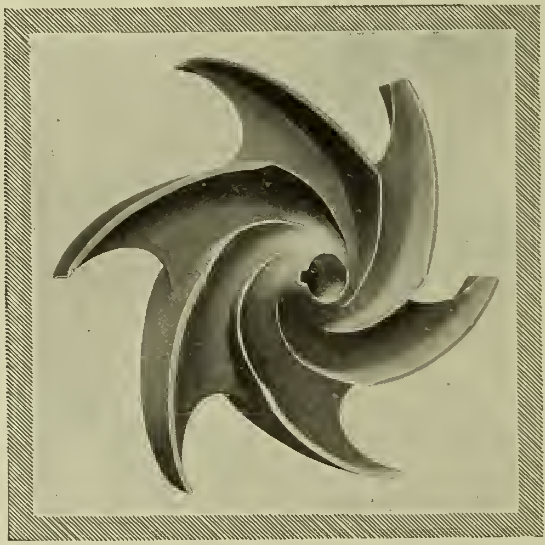
Showing mass of stones and boulders passed through a 10 in. pipe 190 ft. long by a Gwynne Gravel type pump. The section of pipe on top of the heap with stone placed therein, shows the relative proportions.

prises machine, fitting and erecting shops, pattern and smiths' shops, stores and large iron and brass foundries. The works have extensive wharf accommodation and appliances for lifting from or into barges alongside machinery up to 30 tons weight. This is a great convenience when it is remembered that barges can be taken from the wharf right alongside vessels in the various docks of the port and lifted direct on board.

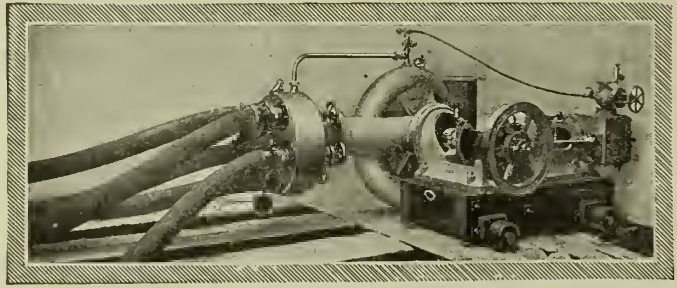


4 in Sewage Pump and Electric Motor.

Mr. John Gwynne, of Hammersmith, was, in the early days of the Hammersmith works, a powerful advocate for replacing reciprocating pumps worked from marine engines by direct-acting centrifugal pumping engines. He is credited with introducing the first of these machines on board ship, and, as is well known, this is now the common practice. In another direction he was an untiring advocate of the great possibilities of the centrifugal pump as a dredging machine. He was very soon rewarded by receiving contracts for very large numbers of sets for various purposes, such as raising sand, mud, stones and for dealing with tailings, slimes, etc., the powerful units fitted to the Mersey Harbour Board dredger *Leviathan*, referred to later, were among the number.



A Sewage Impeller of the Single Suction balanced and self-clearing type.



10 in. Portable Salvage Pumping Engine fitted with a suction box connected to the pump branch, by means of which the 10 in. pipe is divided into 5 pipes of smaller diameter, to enable the pumps to work from fore and aft holds of the stranded vessel simultaneously. Each opening in the suction box is provided with a screw-down valve, so that any one may be thrown out of use if required.

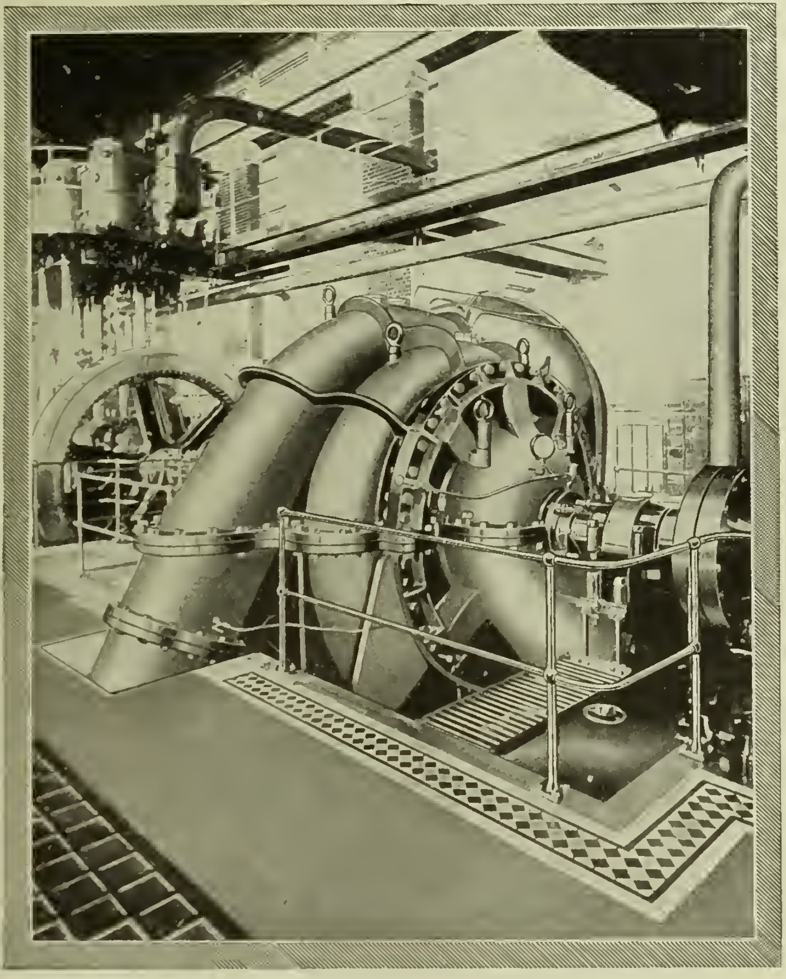
In considering the development and resources of the firm one is impressed by the very large number of important contracts placed with them and by the world-wide market for which they have catered. In its early days the Hammersmith firm secured the large contract for pumping plant for draining the Ferrara marshes in Italy, at that time the largest pumping installation in the world, delivering water at the rate of 2,000 tons per minute through a maximum lift of 12 ft. As indicating the large dimensions of the machines, it is recorded that the body of a young man who had fallen into the canal drifted down to the suction walls and passed through one of the pumps without apparent injury to the body. The majority of large pumping sets fitted in the United Kingdom and on the Continent were for many years supplied by the Gwynne firms. Another large undertaking was that of draining the Harrlemmermeer Podder in Holland. In 1893 two "Invincible" centrifugal pumping engines were installed here, performing together the work of sixteen 73-in. diameter pumps previously used at a very considerable saving in fuel. In the construction of the Amsterdam Canal Gwynne centrifugal pumps were used for dredging, and when the cutting of the Panama Canal was started a considerable number were ordered. The firm's machinery was employed on the trial dredgers used by the authorities at Liverpool as a means of removing the Mersey Bar, and it was in consequence of the successful working of these vessels that the large suction dredger was subsequently brought into existence. The dredger *Leviathan* has already been referred to. This, the largest suction dredger in the world, was constructed at Hammersmith. The contract was for 10,000 tons of solid in 50 minutes from a depth of 70 ft., and the four pumping sets on board dealt with solids equal to a mass 100 ft. long by 52 ft. wide by 52 ft. high in one hour. The "Invincible" pumps are largely used for collieries and mines. They are built up of interchangeable sections without tortuous passages, and the sections are cast without any cored-out parts, enabling all internal passages to be accurately machine moulded, and giving maximum hydraulic efficiency. Messrs. Gwynne's direct-acting centrifugal pumping engines have also been installed in some of the largest installations for water works, dock plants, for reclamation, drainage, irrigation and salvage schemes, and their centrifugal turbine pumps and pumping engines for a wide variety of purposes, including boiler feeding and hydraulic installations, pumping equipment for fire engines and fire floats. Illustrations of several types of plant accompany this article. Messrs. Gwynnes mention that, as a piece of engineering history, the centrifugal pump has scored a sharp line between an old epoch and a new. Whilst its history is comparatively short, its activities are daily developing industry in every corner of the earth. Yet the tasks it has accomplished are probably not a tenth part of those it is destined to achieve, and it seems as though in these years of reconstruction its usefulness and ubiquity are to be demonstrated in quite an exceptional degree. The present works of the company are equipped on the most up-to-date lines for the manufacture and supply of the machinery already mentioned and for pumping engines for all standard and special services with simple, compound and triple-expansion or uniflow steam engines. The organisation of the firm is world-wide, and it is supported by the most intimate knowledge and experience in pumping problems.

IRON AND STEEL INSTITUTE.

AUTUMN MEETING AT CARDIFF.

Many papers of practical importance to the iron and steel industry and engineering generally were submitted to the autumn meeting of the Institute, recently held at Cardiff under the presidency of Dr. J. E. Stead. The contribution by Walter Dixon, M.I.M.E., M.I.E.E., on the electrification of the works and collieries of the Ebbw Vale Steel, Iron and Coal Co., Ltd., dealt shortly with its modern equipment. As usual in such properties, there is a continued and ever increasing demand for power. Steam alone is used for generating power, and gas-fired boilers are installed. The condensing plant is arranged on the "Tinsley" system, plants being driven both electrically and by steam. In the main the transmission lines are erected on the overhead system, though in places it has been necessary to adopt underground cable. Throughout the steelworks electrical power is used for the hundred and one usual purposes. At the collieries electrical power is largely employed for pumps, winders, ventilating fans, and air compressors. Most of the collieries are arranged with their own sub-stations. With the probability of an extended use of compressed air for underground purposes, it is anticipated that a combination of compressors with a regulating set may secure a specially economical working condition in what up to the present is one of the most wasteful and inefficient sources of power. The points of view which require to be taken into consideration where the equipment of such properties is concerned with a view to developing and utilising to the best and most economical advantage the conditions which exist and obtain. Amongst these are :—(1) The best utilisation of blast-furnace and coke-oven gases; (2) the possible economics and advantages (or otherwise) of the adoption of gas-engines; (3) the electric driving of rolling mills as against steam driving; (4) electric winding in collieries as against steam winding; (5) the total electrification of collieries, already wholly or partially equipped with economical steam plant; (6) the generation or purchase of electric power.

A paper on the Formation of Spheroidal Cementite was furnished by Messrs. Kôtarô Honda and Shôzô Saitô, of the Tokoku Imperial University, Sendai, Japan. In this the authors drew attention to the general belief that if a carbon steel be kept for a sufficiently long time at a temperature a little below its critical point—preferably between 600 deg. and 700 deg. C.—the cementite in the pearlite shows a marked tendency to collect in the form of rounded particles embedded in a matrix of ferrite. This phenomenon is called spheroidisation. Pearlite that has undergone spheroidisation is sometimes called globular pearlite. Both hypo- and hyper-eutectoid steels are said to spheroidise more readily than eutectoid steel. It is also admitted that sorbite yields to the spheroidisation treatment more readily than true pearlite, so that for the purpose of spheroidisation the steel must at first be rendered sorbitic. The exact cause of spheroidisation, which has been investigated by Howe, Stead, Arnold, Levy and others, is not yet known. Some metallurgists ascribe the phenomenon to surface tension of the cementite; but this would only explain the phenomenon. In order that the lamellar cementite may change into the globular form it must at first divorce into pieces, and each piece balls up by the action of the surface tension. The surface tension itself, acts, however, against the divorcing of the pearlitic cementite, as the area of the surface thereby is increased. Hence the cause of the divorcing remains to be explained. The experiments referred to in the paper were undertaken to clear up the cause of the formation of the spheroidal cementite.



A Steam-driven Twin Series Pumping Plant supplied by Gwynnes, Ltd., to the London Metropolitan Water Board, and typical of the firm's many large installations. Duty 17,500 gallons per minute. Head 64 feet.

The experiments were made with steels containing 0.31, 0.56, 0.80, 0.94, 1.2, 1.59, 1.95 per cent. of carbon, and a white cast iron with 3.75 per cent. of carbon. The test-specimens in the form of cylindrical rods, 2 centimetres long and 5 millimetres thick, were each covered with kaolin and packed in a short cylindrical copper tube. In order to avoid the oxidation of the specimens, some powdered carbon was put in both ends of the copper tube, which were then closed with asbestos. The tube was placed in a heating furnace of nichrome wire wound round a porcelain tube and distributing temperature uniformly over 10 centimetres. The temperature was measured by means of a platinum and platinum-rhodium thermo-element. The specimens were exposed to the maximum temperature generally for twenty minutes and then slowly cooled in the furnace. The following is a summary of the authors' results :—

(1) If a quenched specimen be heated to below Ac1 point, sorbitic cementite spheroidises.

(2) If a hyper-eutectoil steel be heated above Ac1 point, but below the solubility line, and quenched, the spheroidisation of the super-eutectoid cementite takes place.

(3) If a lamellar pearlitic steel be heated to just the Ac1 point, or a little above this point, for a certain interval of time, spheroidisation takes place.

(4) Granular pearlite spheroidises by being heated below the Ac1 point for a sufficiently long interval of time.

(5) If the Ac1 point be not reached the spheroidisation of lamellar cementite can never proceed. If the maximum temperature exceed a certain limit above the Ac1 point and the steel be then cooled, cementite appears as a lamellar pearlite.

(6) The temperature interval of spheroidisation in low-carbon steels is very small, extending only to about 20 degs.; it increases rapidly with the content of carbon. In very-high-carbon steels the interval amounts to about 100 deg.

Professors Kôtarô Honda and Takejirô Murakami, of Tohoku University, Sendai, Japan, contributed a paper on the Graphitisation of Iron-Carbon Alloys. The object of the authors' investigation was to determine the period of graphite formation in iron-carbon alloys during cooling and the condition of its occurrence, and, if possible, to ascertain the mechanism of graphitisation. This problem has already been investigated by many scientists. Most of them believed that the graphite always resulted from the breaking up of cementite soon after its solidification owing to its unstability. From the mode of occurrence, other scientists, however, insist that it is a product directly separated from the melt. It is argued that if the graphite in cast iron be a product of cementite decomposed in a completely solidified alloy, by the reaction $Fe_3C = 3Fe + C$, some intermediate stage of the change from eutectic cementite to flaky graphite should be found in some alloys cooled under certain conditions. On the other hand, if the graphite is a product directly separated from the molten metal, it should always appear in a eutectic form with austenite; but there are many alloys containing graphite which cannot be considered as a constituent of a eutectic.

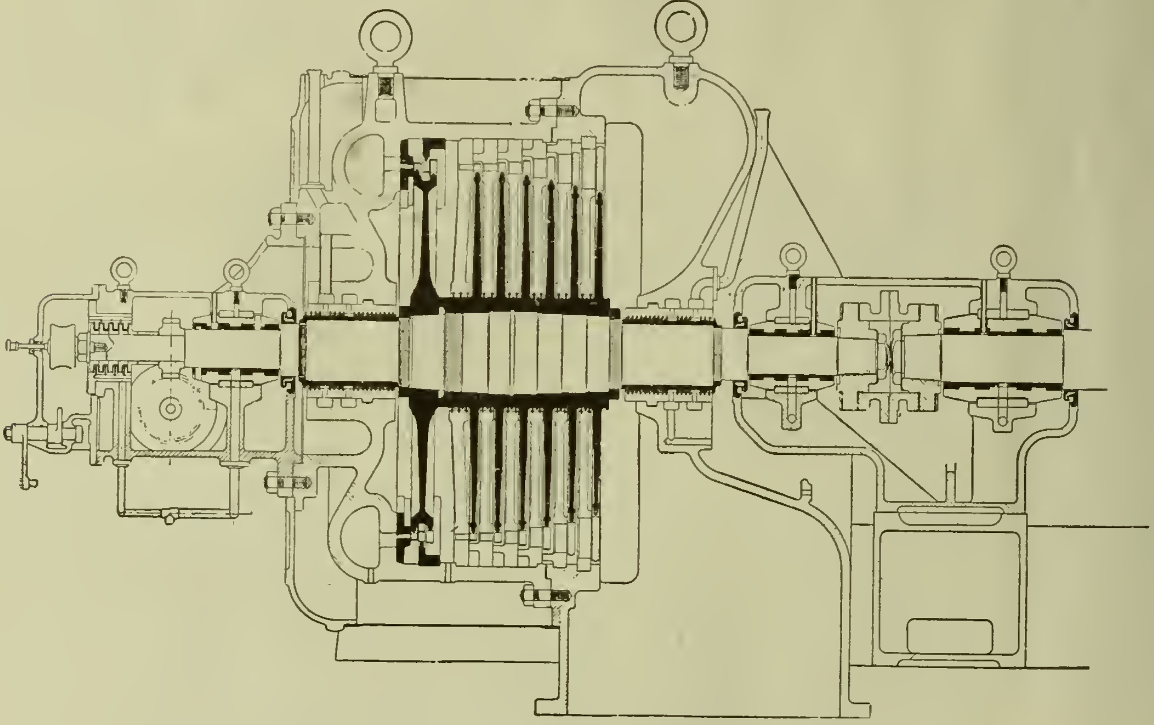
From the results of the present experiment, the following conclusions regarding graphitisation of pure iron-carbon alloys were drawn :—(1) In pure iron-carbon alloys, graphitisation is caused by the decomposition of the cementite solidified during cooling from the melt. (2) Graphitisation is not a direct decomposition of cementite at high temperature according to equation $Fe_3C = 3Fe + C$, but it is caused by a catalytic action of carbon monoxide or dioxide.

Other papers included the Deoxidation of Steel with Hydrogen, by Mr. J. H. Whiteley; the Temper-Brittleness of Nickel Chromium Steels, by Messrs. R. H. Greaves and J. J. A. Jones; a long contribution by M. Eugene Schneider on the investigation of various Forging Operations carried out by hydraulic presses; and a paper on Electric Steels, by Mr. C. G. Carlisle, of Sheffield.

THE STEAM TURBINE.

MECHANICAL SUPERIORITY AND WIDE FIELD OF UTILITY OF MODERN TYPES.

The wide field of application before the steam turbine, the extent of which is not generally realised, and the rapid development of this class of prime mover since the end of the nineteenth century, when higher-grade materials and workmanship rendered such development possible, cause special interest to attach to this description of plant. The particulars given in this article refer to the Rateau and Curtis-Rateau turbines. Since 1905 these types have been specialised in by the Fraser and Chalmers Engineering Works, which have supplied many large installations to the Far East, of which the high-pressure plants at the Hanyeh-Ping Coal and Iron Co.'s concern and at the Shanghai Electrical Undertaking are typical instances. The works are part of the General Electric Co.'s organisation, to which company we are indebted for the details here given. This firm is, of course, well known in the Far East under the style of the General Electric Co. of China, Ltd., with branches at Shanghai, Hongkong and Hankow and representation in Tientsin, Peking, Korea, and Manchuria. The company is also represented in Bangkok and elsewhere in the Far East.



Section of High Pressure 3,000 r.p.m. Turbine Frame.

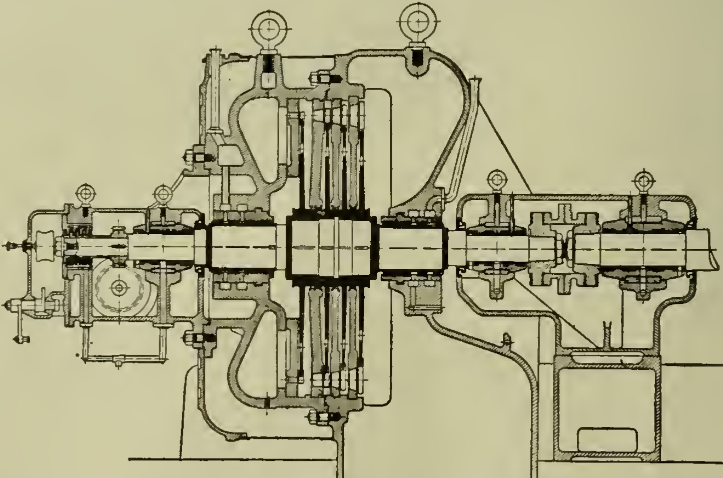
In the Rateau (impulse type) turbine the steam does not expand from high to exhaust pressure in one set of nozzles, but the total available pressure drop is divided into small partial pressure drops. The steam is admitted to a set of nozzles in which it partially expands, and the kinetic energy gained by the expansion is utilised by a moving wheel provided with blades on which the steam from the nozzles impinges. After passing through the wheel the steam enters another set of nozzles or guide blades in which a further pressure drop takes place and the kinetic energy is utilised in the following wheel, this being repeated several times until the exhaust pressure is reached. One set of nozzles or guide blades with one rotating wheel forms a stage, and a number of such stages a Rateau turbine.

It will be noted that the rotating discs provided with blades are fixed on the shaft, and between two of these discs is placed a diaphragm carrying nozzles or guide blades. The expansion takes place only in the nozzles or guide blades, there being no expansion in the moving blades, and consequently the pressure on either side of each moving wheel is the same. For this reason the clearances between the moving parts and the stationary parts can be made sufficiently large to ensure perfect safety. The only point where it is possible for leakage to take place is where the boss of the disc passes through the diaphragm. This, however, is of very small diameter, and the extremely fine clearances can be maintained with absolute safety between the solid bosses of the wheels and the diaphragms by the reliable packings which are employed.

The Rateau turbine permits of much fewer stages than other types to obtain the same efficiency, and consequently is considerably shorter and has an enhanced rigidity and safety.

The Curtis turbine is an impulse turbine consisting of two or more stages. Each stage consists of a set of nozzles where the steam expands and of a wheel carrying two or more rows of moving blades. The steam issuing from the nozzles strikes the first row of moving blades and transmits a large portion of its kinetic energy to the rotating disc. It then passes through guide blades fixed to the turbine casing and is projected on to the second row of moving blades of the velocity wheel. This is repeated if there are more rows of blades on the wheel. The Curtis turbine is cheaper than the Rateau turbine, but less efficient.

The modern tendency is to combine one velocity wheel in the high pressure part of the turbine with a number of Rateau stages in the low pressure part. Although, speaking generally, the velocity wheel is less efficient, it can be designed in many instances so as to have the same efficiency as the Rateau stages in the high pressure part of the turbine.



Low Pressure Turbine.

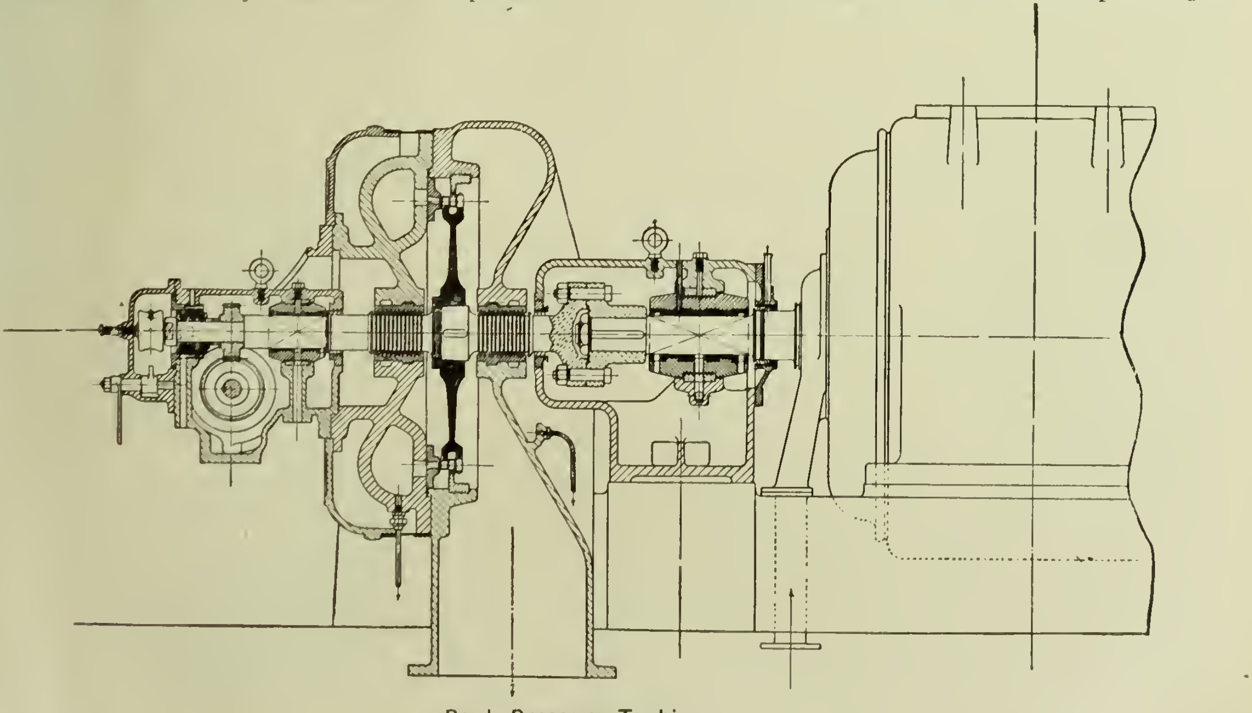
While at the beginning Fraser and Chalmers Engineering Works used to build only pure Rateau turbines, at the present moment the advantages and disadvantages of the Rateau turbine and a combined Curtis and Rateau turbine are carefully weighed and the most suitable type chosen. The first illustration shows a Fraser and Chalmers high pressure turbine consisting of one velocity wheel with two rows of moving blades as the first high pressure stage and a number of single impulse stages. The two rows of blades on the velocity wheel utilise a greater heat drop than a single row on the same diameter wheel. The steam is consequently expanded to a lower temperature and lower pressure in the casing through the first nozzles than is possible when the first stage is built as a single wheel of the same diameter.

For large output turbines operating at high speeds it is advantageous to use wheels of greater diameter. The peripheral speed of the moving blades being thus increased, it is possible to utilise a greater heat drop in one stage than is the case with smaller diameters. Owing to this the temperature and pressure in a turbine with large diameter wheels running at high speed is also moderate.

The makers claim very important advantages for turbines of both the foregoing types, because the low pressure and low temperature to which the casing is exposed allow of simpler design and permit simple and effective packing glands. In addition, close governing is easily obtained for partial loads and overloads.

All governing valves and overload valves on Fraser and Chalmers turbines admit steam to the first nozzles, no live steam being admitted to lower stages. The design eliminates every risk of distortion or undue contraction or expansion of the casing, as well as rapid temperature variations of the different parts of the casing. The overload valves being arranged in front of the first nozzles, the steam must pass through all the stages of the turbine. This gives a better efficiency than where live steam is admitted for overload to a lower stage, as the heat drop would then be utilised in a smaller number of stages.

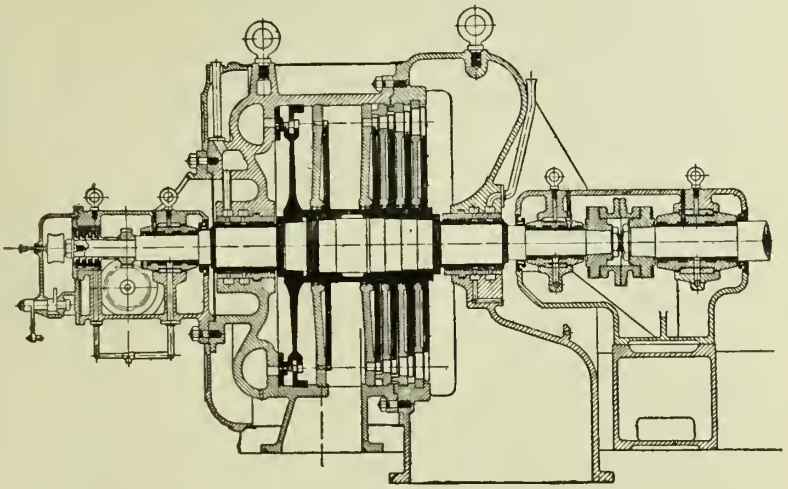
The increased efficiency obtained in recent years is the leading feature of steam turbine plant. By the expression "efficiency," as used above, is meant the ratio of heat actually transformed into mechanical work to heat available in the turbine for mechanical work through adiabatic expansion from the steam conditions at the inlet of the turbine to the steam conditions at the exhaust. The improvement in efficiency is closely connected with development in size. In 1903 a 500 Rateau turbine gave a total efficiency of 56 per cent. Turbines are now built with an efficiency of not less than 75 per cent. for outputs of 5,000 kw. up to 10,000 kw., and for efficiencies as high as 79 per cent. for larger outputs.


Back Pressure Turbine.

Efficiency is also dependent on high pressures, superheats, and vacua. In order to obtain the utmost economy it is necessary that the pressure and temperature of steam at the inlet of the turbine be high and the vacuum at the exhaust good. While 20 years ago a steam pressure of 100 lb. per square inch was usual, and very rarely superheat had been provided for, modern steam plants are designed for steam pressures of 200 lb. per square inch or higher, and for steam temperatures up to or exceeding 700 degs. F. The condensers have also been considerably improved, and vacua of 28½ to 29 inches, with a barometric pressure of 30 inches, are nowadays quite usual.

The Fraser and Chalmers Engineering Works manufacture steam turbines of the following types, sectional illustrations of most of which accompany this article.

High Pressure: Steam is admitted from the boilers. Some of the potential energy of the steam is converted by the expansion in the first nozzle into kinetic energy. The velocity of the steam leaving the nozzles is utilised in the first row of moving blades, transmitting a large portion of its kinetic energy to the rotating disc; it then passes through guide blades fixed to the turbine casing and is projected on to the second row of the moving blades of the velocity wheel. The steam then passes through the first diaphragm, in which it expands, the kinetic energy gained by the expansion being utilised in the moving wheel after the diaphragm, this process being repeated through all the successive stages. The steam is exhausted into a condenser.


Mixed Pressure Turbine.

Low Pressure: Utilising exhaust steam from engines working continuously or intermittently. In the latter case a heat accumulator inserted between the reciprocating engines and the low pressure turbine equalises the fluctuation of steam supply. The low pressure turbine exhausts into a condenser.

Mixed Pressure: For utilisation of two or more steam supplies at different pressures. These turbines operate with either one of the steam supplies or two or more supplies combined. Fraser and Chalmers Engineering Works manufacture a special mixed pressure governing gear which controls automatically the different steam supplies.

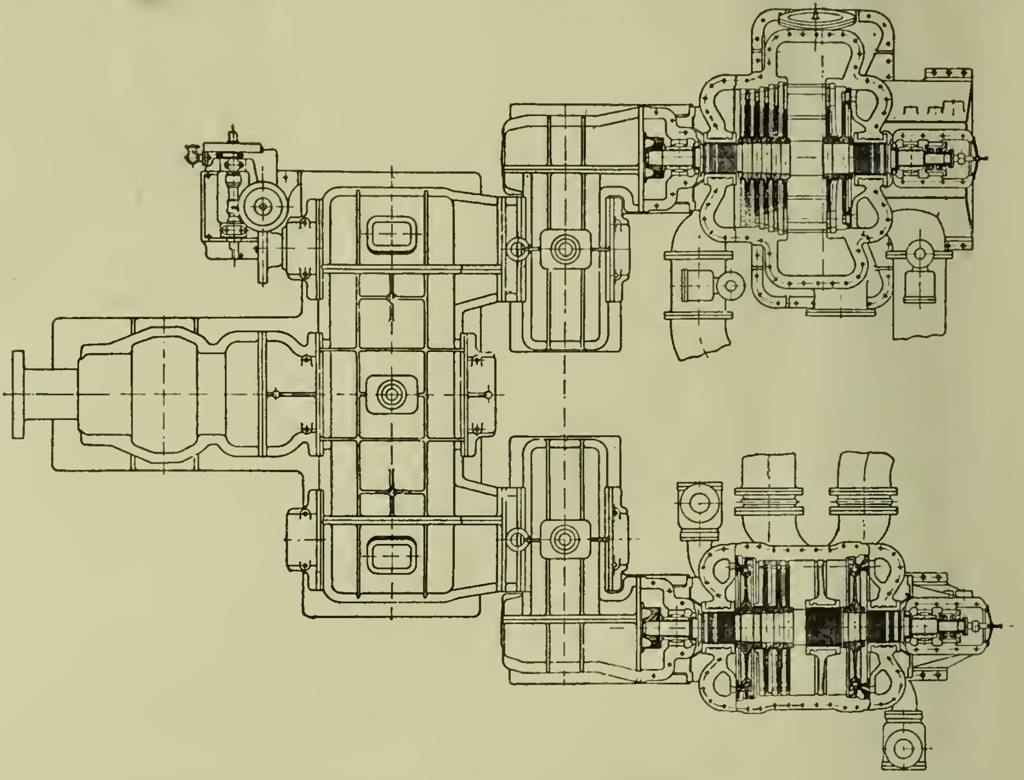
Back Pressure: This type is very suitable for chemical factories, textile industries, paper mills, sugar refineries, breweries, laundries, and generally for cases where steam is used for heating and cooking purposes at the same time as for power generation. The turbine receives steam from the boilers and exhausts it into a heating and cooking system.

Reducing or Bleeder Turbines:—Where the supply of heating steam is liable to large fluctuations this type should be installed. The steam is admitted from the boilers into the turbine, where it expands to a predetermined pressure, at which a portion of the steam is passed out for heating purposes, the remaining portion expanding further in lower stages, after which it is exhausted into a condenser. This type of turbine can work as a high pressure turbine if no steam is wanted for heating, or as a back pressure turbine if all the steam necessary for power production is wanted for heating. The amount of heating steam can fluctuate between these limits.

The Fraser and Chalmers Engineering Works have also developed steam turbines for marine propulsion. Among the purposes for which the steam turbines already described are applicable are those for driving turbo-alternators, a duty with which the steam turbine is most generally associated. In recent years turbines have been used for driving continuous current generators through speed reduction gear. Turbines are also being widely employed for rotary type blowers, compressors and pumps. The Fraser and Chalmers Engineering Works claim to be the first firm to take up the manufacture of Rateau type centrifugal blowers and compressors.

The steam turbine may be used for driving shafting through reduction gears in cotton mills, oil factories, etc., for driving rolling mills through reduction gears or through reduction gears and rope drives. To-day the steam turbine is the most usual machine for marine propulsion. It may be applied for driving the propeller directly or through reduction gears or for driving a turbo-alternator, supplying current to motors which, in their turn, drive propellers.

The steam turbine is particularly suitable for the utilisation of waste heat such as is obtained from gas and oil engines. The waste heat produces steam in separate boilers, that steam driving steam turbines. The steam turbine has also found a very large application as an auxiliary, particularly for driving boiler feed pumps of the centrifugal type, small ship lighting, generators, fans, pumps, etc., on board ships. Very often, too, auxiliary steam turbines are used for driving condenser pumps. Generally speaking, the steam turbine has conquered practically all the fields which the steam engine used to dominate.



Section of a typical Marine Steam Turbine. The turbine is divided in two casings, the h.p. one containing one velocity wheel and three single wheels for the ahead turbine and one velocity wheel for the astern turbine. The ahead turbine on the low pressure casing consists of five single wheels, the astern low pressure part consisting of two single wheels. For smaller plants the turbines could be built in a single casing, containing both ahead and astern turbines.

DUTCH EAST INDIES TRADE.

If the proposals for establishing a permanent Industrial Fair in Java materialise, and the enterprise is conducted on efficient lines, support from British manufacturing interests seems assured. Large potential markets exist in the Dutch East Indies for iron and steel and machinery generally, and for some little time past such markets have been brought prominently to the notice of British producers.

A large demand may be expected for modern machinery, for rubber, coconut, tea, sugar and tobacco estates, and for treating the produce of these estates. Requirements for rails should also prove extensive and varied. Rails are needed by the State railways and for certain tramway systems. Rails are also needed for mines and sugar estates. An order was recently placed by the Purchasing Bureau of the Netherlands Government for 150,000 tons of material, mostly made up of rails.

Statistics show that the import of bars, flats, sheets and plates into the Dutch East Indies increased from 25,001 metric tons in 1917 to 27,024 metric tons in 1918. These amounts are arbitrarily valued at 500 guilders per ton (1 guilder equals .402 dol.) by the Division of Imports and Exports. Round mild steel is in general demand from 3-16 up to 2 in., and importers normally carry considerable stocks.

Plates for tanks of mild steel are imported in large quantities, the bulk of the business being in gauges of 3-16, ¼ and ⅜ in. There is a steady demand for installations in vegetable and mineral plants, and for repairs. The large bulk of the business in sheets is 28 gauge, galvanised, in sizes of 3 by 6 and 3 by 8 ft.

A good deal of structural work is due to be put in hand, as many contracts undertaken at the outbreak of the war were postponed or reduced to a minimum. Beams of structural sizes are used very little in this colony, it being claimed that it is cheaper to build up the desired strength from small shapes and flat iron with the cheap local labour. Small shapes are needed in large quantities for building warehouses, sugar sheds, factories and plantation works. The work is very largely standardised. Corrugated iron for Java and Madura is almost invariably in 24 gauge, 26 in. wide, with eight 3-in. corrugations, approximately ⅝ in. deep. Lengths run from 5 to 10 ft., with the bulk of the business in 6 to 8-ft. lengths. In Sumatra the demand is generally for 28 gauge, and sometimes for 31 and 32 gauge, with the other dimensions the same as for Java. Packing is invariably in skeleton cases (crates) in approximately 4-picul (1 picul equals 136 lbs.) weights. The trade in corrugated roofing will undoubtedly increase as it becomes easier to get steel shapes for building.

Both America and Japan are exploiting the commercial possibilities of the East Indies. Since 1918 the United States have supplied a large percentage of the total imports.

Regarding Japan's trade with the Dutch Indies, the *Bulletin* of the F.B.I. mentions an increase of approximately 170 per cent. during the first three months of the current year as compared with a year ago. The increase in the exports of cotton textiles from Japan was mainly responsible for this rise, assisted by exports of porcelain, earthenware and cement. There was a decrease in the totals for iron, electrical goods and machinery.

It is worthy of note that other countries besides America and Japan are evincing keen interest in the commercial possibilities of the Dutch East Indies, as witnessed in the appointment of a commercial attaché to the Swedish Consulate-General at Batavia.

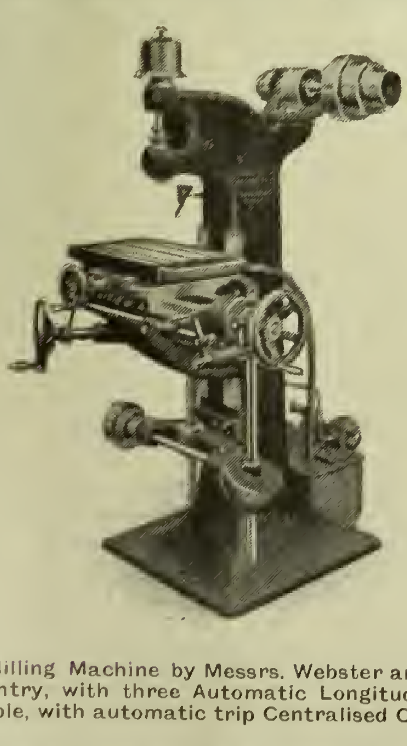
MACHINE TOOL DEVELOPMENT.

EXHIBITS AT THE MACHINE TOOL EXHIBITION IN LONDON.

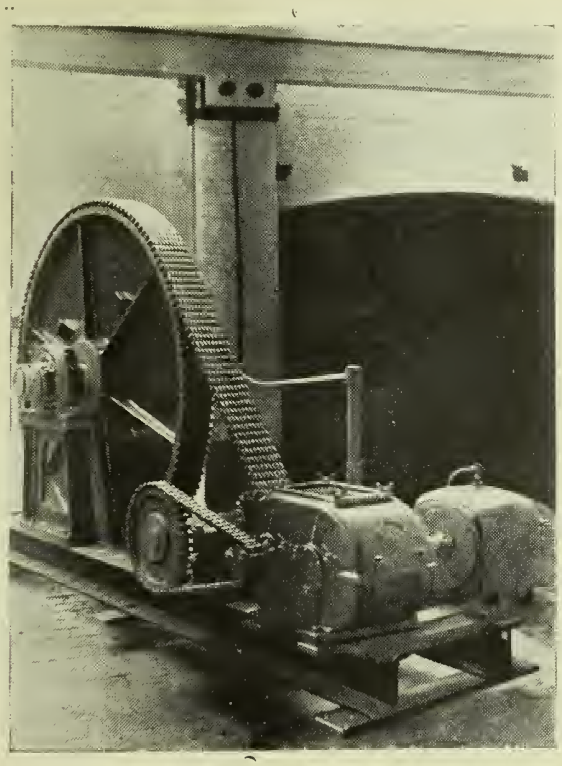
Broadly considered, very great success attended the second Machine Tool and Engineering Exhibition just held in London, under the organisation of the Machine Tool Trades Association. It proved beyond doubt the immense progress Great Britain has made in the design and manufacture of machine tools and the rapid development caused by war conditions in mass production and repetition work. The Exhibition contained over 1,500 exhibits, varying in weight from a few ounces to many tons, and representing a total value of over £1,000,000. Twelve thousand invitations had been sent out by the organisers, and for the greater portion of its career the exhibition was well attended. The large number of visitors from overseas, or who were concerned with overseas trade, was a feature on many days. Manufacturers, merchant firms and agents were brought closely into touch with one another, a fact which should bring a potent influence to bear on export trade in the future.

Regarding the exhibition in the light it afforded on the general development of machine tools, the improvement in detail, design, finish and workmanship of British tools was perhaps the outstanding feature, and has been a subject for general comment. Many of the exhibitors were merchant firms, as well as manufacturers, and the same stands often housed a variety of tools by several makers and produced in different countries. This fact tended to obscure the development of British tools in a cursory examination. More detailed investigation, however, showed how sound and far-reaching such development has become, and that British makers may claim a foremost position in what is really a most important key industry. Although specialisation has increased, few firms yet specialise in particular tools. A large number of the machines shown were seen actually working, and the increasing use of the electrical drive was in evidence. Modern design, moreover, lends itself to this system of working. Gears, chains, or belts were used for power transmission and speed reduction. Individual motors were installed in many instances.

In view of the general trend of engineering practice, grinding machines were much in evidence on many stands, and some of the most notable developments were seen in this direction. Messrs. Luke and Spencer, of Broadheath, Manchester, showed a modern type of automatic shear blade grinder, which permits of the most delicate adjustment to suit various classes of work. Fully capable of accurately grinding paper and leather-cutting knives, straight edges; also shear blades for ship and boiler plates. This is a thoroughly useful machine for surfacing slide bars and parallel or taper strips. A patent universal cutter and tool-grinding machine exhibited by Messrs. Alfred Herbert, of Coventry, is used to sharpen cutters, reamers, etc., in use on other machines. In addition to grinding milling cutters, the machine is intended for general tool-room use, and will do almost any variety of circular and surface grinding. The patented feature which adds to the universality of the machine is the combination of quick and slow movements to the two conjugate adjustments of the table, by which either the longitudinal or the cross adjustment may be used for traversing the work across the wheel with a quick feed or for putting on the cut with a fine feed. This enables a greater variety of work to be ground without special appliances than on any other machine. Micrometer adjustments are provided to ensure accuracy. The same firm also showed a new design of the Norton plane machine. The drive to the wheel-head is vertical from below, allowing an improved type of wheel spindle. All the load being upon the bottom half-bearing, the spindle requires little holding down.



Vertical Milling Machine by Messrs. Webster and Bennett, Ltd., Coventry, with three Automatic Longitudinal Feeds to Table, with automatic trip Centralised Control.



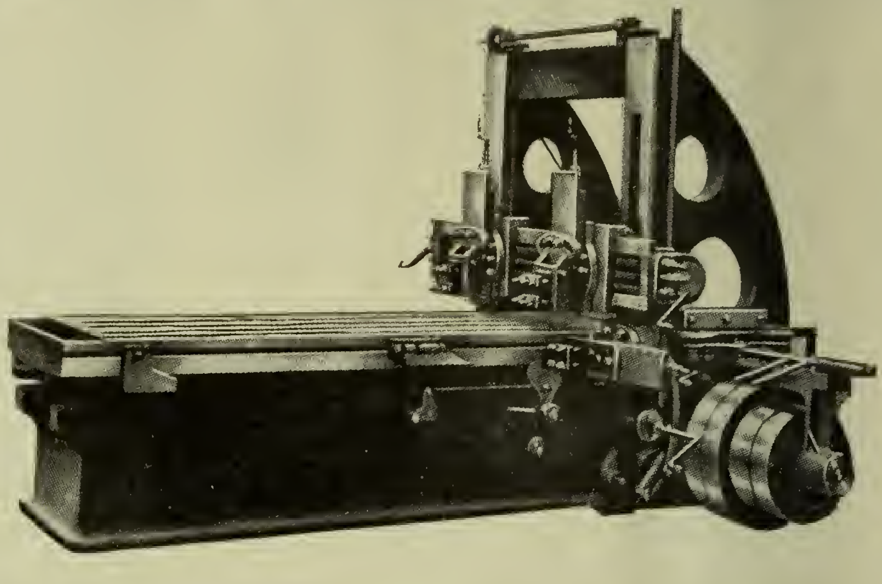
Drive exhibited by the "Coventry" Chain Co., Ltd., having a ratio of reduction of 680 to 1. The exhibit showed the efficiency of the "Coventry" inverted tooth (noiseless) high speed power transmission drive and of the single and duplex roller chains for industrial drives where the speed is not so high; of the Company's reduction gear boxes which are made in duplex, triplex and quadruplex for full range of horse powers and ratios.

Many improvements were noticeable in gear-cutting machines. The tendency is to employ some version of generating principle. In the worm wheel generator shown by Messrs. David Brown and Sons, Ltd., of Huddersfield, the drive, by single pulley, friction clutch and four-speed gear-box, subsequently separates to cutter-head and work table, which carry hob and blank respectively, these latter being driven at correct relative speeds according to the ratio of the gears being cut. The cutter head is located by micrometer adjustment, and the hob is fed longitudinally across the face of the blank. After a predetermined travel, the feed mechanism is automatically disengaged. To facilitate "setting up," the dividing mechanism can be quickly disconnected, which allows the work table to be rotated by hand, and the blank is mounted on a micrometer adapter, to allow of vertical adjustment. A patent double helical gear generating machine was shown by the Power Plant Co., Ltd., of West Drayton, to cut wheels and pinions from ½ inch to 27½ inches diameter, up to 12 inches face width. Also a special machine for high precision work and adapted to cut turbine gears from 2 inches to 53 inches diameter and up to 20 inches face width.

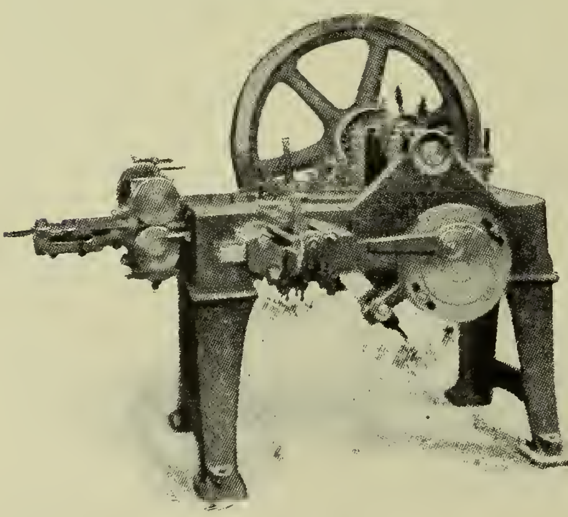
In the heavier types of lathes, milling machines, etc., modern practice is to increase rigidity and power supply. Both in the horizontal and vertical types single-pulley, all-gear heads are employed. Spindle speeds and the various feeds are set by interlocked levers from one side of the machine, and the controls are operated from the front.

Very complete ranges of certain classes of tools were on view, among these being drilling machines. Messrs. James Archdale and Co., Ltd., of Birmingham, showed their centralised control radial drilling machine, 4 ft.

6 in. radius, with elevating arm. This machine is of entirely new design, embodying patented devices. The saddle and sleeve lock are operated simultaneously. The arm may be swung and saddle moved, then both locked by one movement of the lever. There are eighteen spindle speeds (including double gear), changed by lever; all working levers are operated from a central control position on the saddle. By the automatic stop motion, improved dial type, the stop is instantly adjusted and positively located. With the interlocking elevating control and arm lock, one lever movement unlocks the arm clamping bolt and operates power elevating gear. All driving shafts up to and including the horizontal arm shaft run at constant high speed. It has been found by numerous tests that this type of drive is most efficient. Four feeds are engaged by instantly operated friction clutch. The spindle is reversible for tapping. Ball journals and thrusts are fitted to important bearings. The machine is motor driven, the power required being 7½ h.p. The machine will drill to 2¼ in. in mild steel, and 1 in. diameter in mild steel at 9.2 in. per minute.



Heavy Duty Planing Machine by C. Redman and Sons, Ltd., Halifax four-speed electrically driven.



Double-stroke Rivet Heading Machine by Greenwood and Batley, Ltd., Leeds

Among the more important exhibits were those of the Birmingham Small Arms and their selling agents, Messrs. Burton Griffiths and Co., Ltd. Several large stands were occupied by Messrs. Alfred Herbert and Co., Ltd., and their associated companies. The Associated British Machine Tool Makers, Ltd., who are represented in China by Messrs. Jardine, Matheson and Co., Ltd., showed a very complete range of machines. These included horizontal boring, drilling, tapping, stud inserting and milling machines by Messrs. Thomas Shanks and Co., driven by constant speed motor, mounted on the column, and thus required no long driving shaft in the bed. This drill slide has hand and quick power raising and lowering motions, also six milling feeds in each direction. Hand feed suitable for surface work and quick hand traverse are provided for moving the spindle; ball thrust washers are interposed between the spindle and the rack to take end pressure. By means of a patented selector, all the various motions are centralised at the front in a way not hitherto accomplished, and the attendant can control the machine at any height, while stops are provided to all the slides. The exhibits of the Associated British Machine Tool Makers, Ltd., also included improved types of automatic turret lathe and automatic screw machines by Messrs. Thos. White and Sons, Ltd., of Paisley; cutting-off machine for steel bars, with automatic withdrawal of tools, by Messrs. Clifton and Baird, Ltd., of Johnstone; duplex boring and turning mill and disc grinder, by Messrs. Roberts Bros., of Dukinfield; single-pulley plain horizontal milling machine, bevel gear planer, relieving lathe, key seating and morticing machine, ball-bearing sensitive drilling machine, and broaching machine, by Messrs. Smith and Coventry, of Manchester, with many latest developments in lathes by Messrs. John Lang and Sons, Ltd., of Johnstone. Special attention is directed to the 30-in. swing, surfacing and boring lathe, with patent variable speed headstock, driven by constant speed electric motor. This headstock is fitted with Langs' patent automatic speed changing mechanism, whereby the revolutions of spindle automatically increase as the tool travels towards the centre. By this means a surface can be finished in one-half the time taken on an ordinary step cone lathe. Further features to which attention is drawn in this lathe are the patent covered bed, which prevents cuttings from falling on the working surfaces of the lathe bed, the four-feed gear-box, and the large hexagon turret for carrying 6 tool holders.

Messrs. Vickers, Ltd., showed one of their new broaching machines manufactured at their Erith works. The body of this machine consists of two main castings, having a fitted joint on the centre line of the screw. Within this body runs the whole of the gearing immersed in oil, which is also arranged automatically to lubricate the high-speed bearings. The guide is of " U " section. The large crown gear transmitting power to the cutting stroke is supported by and runs in a bronzed-lined bearing, and is made of tough close-grained cast iron. The pinions in mesh with this, together with all the change gears, are of steel, machine cut. The whole gear train applies to the cutting stroke only; consequently it is never reversed, but is driven by a constant speed single pulley in one direction. In all types of broaching machines the return stroke is always non-productive; therefore, it is in this direction that economy must be sought. With this object in view, Messrs. Vickers have introduced patented features which increase to a very great extent the productive capacity of this class of machine. This is effected by a self-contained unit, driven by a separate belt at the back of the machine. The element which operatively connects alternatively either the cutting or return stroke is controlled by a cam plate, which also moves the return belt. The operation of this cam plate is so timed that no collision of the two motions can possibly take place. Hand control can be accomplished from both sides. Demonstrations were also given of the Vickers (Sheffield Works) patent local surface hardening process. By this process the article can be completely finish-machined, and the surfaces locally hardened in a few minutes, when the article is ready for immediate use.

JAPAN'S COMPETITION WITH BRITISH GOODS IN OVERSEAS MARKETS.

Some interesting and exact information under this head is forthcoming in a recent report by H.M. Commercial Secretary at Tokyo. So far as high-class modern machinery and engineering equipment are concerned British trade is not seriously threatened if British goods are forthcoming and manufacturers show adequate enterprise in exploiting foreign markets. Nevertheless, electrical machinery and textile machinery are going out of Japan in increasing quantities, the former chiefly to China and the Kwantung Province (through Dairen). Spinning machinery went to China, probably for the Japanese mills in Tsingtao and Shanghai, and also to India, where, however, it is not expected to find a sale if British plant is available. Japanese textile machinery does not yet find favour in the domestic industry, and it is too much to expect that it will find a readier market elsewhere if British machinery is forthcoming. Part of the exports also consist of second-hand machinery.

It should here be emphasised that Great Britain's position as a supplier of Japan's machinery requirements is affected by the United States. It will be affected, too, by the great advance which is being made in local manufacture, especially of electrical machinery, under arrangements with British and American concerns.

Being cut off from many sources of supply during the war, Japanese engineers were obliged to turn to home supplies and a great advance was made in local manufacture. Given a model on which to work, local production is now of satisfactory quality, especially in electrical machinery, and several concerns have made agreements with British and American concerns whereby the latter allow their patents to be worked in Japan against payment of royalty. The General Electric Company of America has considerable interests in two large concerns in which their models are produced for the local market. Japanese engineers are at all times greatly dependent on training and instruction from foreign countries, and the impossibility of getting assistance of this kind from Europe during the war caused a considerable number of engineering and other students to take their training in America, and accordingly these men will doubtless continue to prefer the American machinery which they have learnt to handle from the outset.

Japanese cotton spinners have hitherto modelled their system on British methods and machinery; Japanese electrical practice has always followed America and Germany; and mining engineering America.

Export of metals and metal manufactures show a strong tendency to fall away from recent prosperity. Tungsten and antimony, which were shipped to the United States of America in big quantities for war supplies, have declined to almost negligible quantities. Copper, taken largely by Great Britain and France during the war, shows a similar decrease—in fact, there has been a considerable import of copper during 1919 owing to the high prices ruling in Japan. In 1917 the exports of copper were over 120 million kin; in 1919 they were about 32 million kin, valued at yen 19,647,000. The stocks of copper at the end of October, 1919, were about 30 million kin. Iron has increased considerably in quantity, but decreased heavily in value; for example, in 1918 the returns for ingots and slabs were 11,020,155 kin valued at yen 2,685,854. In 1919 shipments were over 23 million kin in quantity and yen 2,661,000 in value.

The manufacture of wire rope is an interesting development. The exports of this article did not appear in the Official Returns until 1917, when over 11 million kin, valued at yen 3,634,000, were shipped, over 80 per cent. going to Asiatic Russia. In 1918 exports decreased to 9 million kin, valued at 6½ million yen, due to the comparative disappearance of the Siberian demand, although shipments to India, Java, and China increased very considerably. The figures for 1919, however, show a further decline—2,397,330 kin, valued at yen 1,435,700. It would thus appear that the Japanese manufacturer has not yet made sufficient progress to compete against European and American goods.

In chemicals Japan is now manufacturing most of the heavy chemicals required for industrial use, and in many of them taking her place as a competitor in foreign markets. Those which are not yet made there in sufficient quantity to meet the domestic demand include 60 per cent. caustic soda, glycerine, salicylic acid, yellow phosphorus, formaldehyde, aniline salt, acetate of lime, sulphate of ammonia, and carbolic acid. Japan is destined to become self-supporting in most heavy chemicals and an important factor to be reckoned with in foreign markets.

In connection with the establishment of an agency of the British Dyestuffs Corporation in Japan, it is noteworthy that the present is a most opportune time for extending business in dyes. American goods are in disfavour, the Japanese industry is not yet developed, and the import of German colours is impracticable on a large scale. The Swiss dye trade with Japan shows signs of recovery.

Browett, Lindley & Co., Ltd., the high-speed engine manufacturers, of Patricroft, Manchester, will pay interim dividends of 4 per cent. (actual) on the ordinary shares, 3 per cent. (actual) on the preference shares, and 3 per cent. (actual) on account of arrears.

The directors of the Shanghai Electric Construction Co., Ltd., recommend an interim dividend at the rate of 6 per cent. per annum, less tax.

BOOKS.

THE ENGINEERING ENQUIRY.

By Tomey Thompson, A.M.I.Mech.E. Bristol: J. W. Arrowsmith, Ltd. 7s. 6d.

This new pocket book for engineers and machinery users has been published in order to assist purchasing and selling engineers, representatives, agents, managers, contractors, merchants, and others in specifying in their *first* inquiries for machinery, the full information needed by manufacturers or sellers for purposes of quotation, tendering, etc. The assumption is made, for instance, that a pump is required. The prospective purchaser turns to the pump section of the book, where he is advised that in order to obtain promptly a "firm" tender and best prices he must specify in his inquiry information under some fifteen separate items, such as type of pump required, quantity of water or liquid to be pumped per minute or hour, total lift and so on. The book is exhaustive, and deals with inquiries covering the bulk of mechanical and electrical products and accessories. The efficiency of such a work is easily tested by comparing the particulars it suggests should be given with the particulars sometimes asked for in certain manufacturers' catalogues. This test we have applied, and in each instance the book has answered admirably. Little comment is needed to indicate the value of such a work in the Far East and in foreign markets generally. Such centres send in the aggregate an immense number of inquiries for machinery, and delay and expense are often incurred when such inquiries give incomplete or vague particulars. Mr. Thompson's work will obviate this. It certainly merits a very wide circle of users, and abroad it fills a very real want indeed.

AMERICAN CIVIL ENGINEERS' HANDBOOK.

By Mansfield Merriman, M.Am.S.C.E., Editor-in-Chief. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 33s. net.

This work, which is well known amongst engineers, has now reached its fourth edition. It was first published as a pocket-book in 1910, but the present edition has been so much enlarged that the volume is now properly termed a handbook. Mr. Merriman has received the assistance of eighteen associate editors, and more than ever before the work has become a valuable and authoritative book of reference to all engaged in civil engineering. Although practical throughout the work has been prepared on a high plane, and the reader is supposed to have a good knowledge of elementary mathematics. In all sections the matter has been condensed, so that the greatest amount may be put into the assigned space, and at the same time be clearly represented. Each associate editor is responsible for the subject matter of his section. The sections include Mathematical Tables, by M. Merriman; Surveying, Geodesy and Railroad Location, by Professor Charles B. Breed; Steam Railroads, by Professor Fred. Asa Barnes; Electric Railroads, by Wm. A. Delmar, M.Am.I.E.E.; Materials of Construction, by Professor Herbert F. Moore; Plain and Reinforced Concrete, by Frederick E. Turneaure; Masonry, Foundations, and Earthwork, by Professor Ira O. Baker; Masonry and Timber Structures, by Walter J. Douglas, M.Am.S.C.E.; Steel Structures, by Professor Frank H. Constant; Hydraulics, Pumping and Water Power, by Professor Gardner S. Williams; Water Supply, Sewerage and Irrigation, by Allen Hazen, M.Am.S.C.E.; Dams, Aqueducts, Canals, Shafts and Tunnels, by Silas H. Woodard, M.Am.S.C.E.; Mathematics and Mechanics, by Professor E. R. Maurer; Physics, Meteorology, Weights and Measures, by Louis A. Fischer; Steam and Electric Engineering, by Professor Geo. A. Goodenough and F. Malcolm Farmer; Highway Engineering, by Professor A. H. Blanchard; Harbour and River Works, by Fred. R. Harris; and Irrigation and Drainage, by Professor Horace W. King. This is a new section to the fourth edition. All other sections have been revised and brought to date, being in some cases re-written and much enlarged. The work is well divided and arranged, for which task the editor-in-chief has been responsible, and the great value of the volume is rendered easily available by an exhaustive index compiled by Clinton L. Bogert, A.M.Am.S.C.E. The volume consists of very nearly 2,000 pages, the pages measuring 4 in. by 6¾ in., and the composition, printing and binding are admirable.

STRENGTH OF MATERIALS.

By John Paul Kottcamp, M.A.S.M.E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 7s. 6d. net.

This is a text book for technical and industrial schools, and it well merits a high place in the rather large volume of literature available in the branch of engineering of which it treats. The work is the result of over twelve years' experience in teaching the subject of strength of materials to students, and the clear and practical manner in which the author handles his subject is evidence of this. The book contains a minimum of mathematics, and fundamental and underlying principles are applied by the introduction of examples worked out in detail. The little volume should prove of great help on both mechanical and structural work. Chapter 1 is of an introductory nature, dealing with conditions of equilibrium, and this is followed by articles on simple stresses. One of the most valuable chapters for the student deals with materials of construction and modern methods for their production. The theory, design and deformation of beams is treated at some length, followed by chapters on shafting, columns and riveted joints. Questions of combined stresses and resilience are explained in a separate chapter, with articles on flexture and tension, stresses in machine frames, modulus of resilience, formulæ for elastic resilience, and stresses due to temperature. The last chapter deals with reinforced concrete construction. In all sections of the work complications are avoided, and the book has a large field of usefulness if read in conjunction with or as a preliminary to the study of higher works on applied mechanics.

MODERN ENGINEERING PRACTICE.

ON THE SELECTION OF STOKERS.

Some useful advice on the selection of stokers was recently submitted to a meeting of the Assam branch of the Junior Institution of Engineers. When the time comes to make up one's establishment of stokers, do not judge a man's abilities or service by his energy during the act of replenishing his fires; just note his method of applying the fuel, register for a few hours the variations in his boiler steam pressure or his firing machine temperature, and the amount of fuel the fire is consuming; also note the condition of the discharge of waste gas at the chimney. Firing a furnace is not an unskilled labourer's work. So, when selecting firemen, pick out good men, possessing more than the usual intelligence, give them a suitable wage, and endeavour to give them a rudimentary schooling on the subject, and where possible show them one or two minor experiments: and if you discover a man with a special aptitude for the work, teach him individually all you can, and then later put him in charge of two, three, four, or five furnaces, where you will find that he will coach others of his workmates in half the time you yourself could do it. Another point for summing up a stoker's abilities is to examine his slices; where one finds that a man's slice is being quickly burned away one may fairly surely surmise that the tool is really being put to the proper use. Where long hours in the factory are usual, endeavour to put your firemen on watches of four hours' work and eight hours off. Teach them above all that cleanliness is all important with regard to the flues of their respective machines. Do not let your men damp their ashes near the ashpit, for in doing this sulphur dioxide is generated, and, being carried through the fire-bars, immediately smothers the fire.

LUBRICATION IN DIESEL ENGINE OPERATION.

Supplies of fresh lubricant, when being stored, must under no circumstances be put into vessels which have previously held fuel oil, nor must the oil be passed through fuel oil hose without most careful cleansing. The filters must also be closely watched, and if these commence to show very fine black deposits from the lubricant, a close survey is recommended, and it is important to make sure that no burnt oil deposits from pistons are passing the gland distance-piece or stuffing-box into the lubrication system of the crank chamber. A sudden and abnormal rise of pressure in the lubrication system requires instant attention, as if it is not the outcome of fresh oil additions, or a fall in the temperature of the engine-room, the forced lubrication pump being in good order and no obstruction in the supply system, an examination of the filters is necessary. Probably water has gained access to the system, and it must be got out as soon as possible. Where the water is fresh or pure, the oil containing it should be drawn off and the water settled out by heating. Sometimes annoying leaks occur from the water-cooled exhaust valves or cages, and the water finds its way into the oil system. Trouble also arises from leakage of water at the point where the oil passes to the pistons through the jacket, although such cases are not frequent. Where the pistons also are water-cooled, a close look-out should be kept for leakage of water, and where the pistons are oil-cooled internally the oil selected should be of high quality. Care should also be exercised when dismantling

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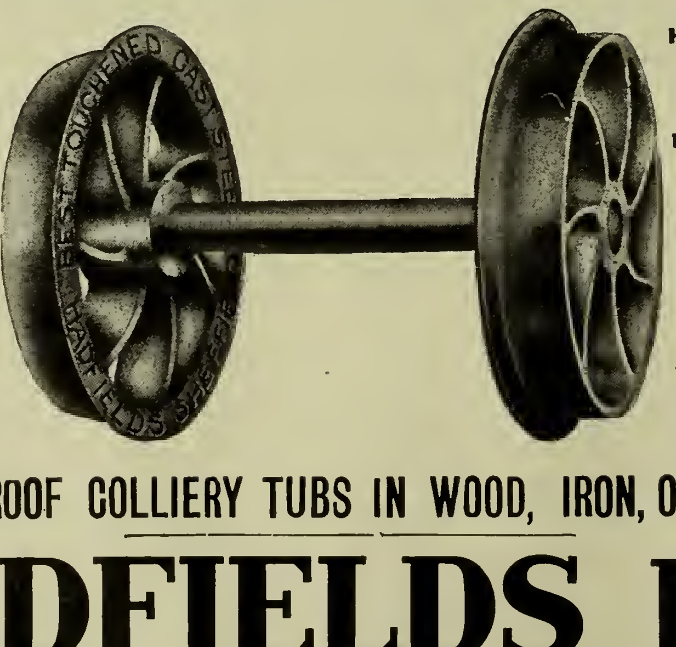

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the valves, cylinder covers, and, when the water connections are broken, to ensure that water is excluded from the lubrication system. Should there be a considerable fall of pressure, frequent examinations of the lubricants from the filters should be made, and if it is certain the pumps are in order, make sure by observation and smell that no fuel oil has found its way to the crank-case or has passed the pistons unburnt, particularly after a cylinder has been sluggish or combustion not satisfactory. Close observation should be kept of the daily supply tank when very heavy fuel oils are mixed with lighter oils, and the mixture should be uniform, otherwise the engine-running is affected. Needless to say, a sharp look-out for water in the fuel oil is highly essential. Attention to the uniform cooling of exhaust valves and cages and water jackets and pistons is also a factor that makes for good running. Temperatures between 120 degs. F. and 160 degs. F. are generally the best both for thermal efficiency and for long life of working parts.

TESTING STEEL PRODUCTS.

A simple explanation of the Shore Schleroscope test for measuring the surface hardness of steel, as opposed to the Brinell test, which determines the general hardness, is furnished by Messrs. Edgar Allen and Co. in their *Edgar Allen News*. The instrument itself consists of an ingenious contrivance for the dropping of a small standard hammer, fitted with a sapphire point, on to the surface of the test-piece from a standard height. The hammer rebounds, of course, to a certain height after striking the surface, and this height gives a measure of surface hardness. The measurement will vary with the thickness of the metal tested, and will be higher when the test is applied to a casting just above a blowhole than when applied to sound parts. The Schleroscope in reality only measures the "springiness" of the surface, and therefore, if applied to a surface where "springing" is likely to occur, it may give an erroneous reading. This point should be watched. Best results are obtained when the test is made at the same point on parts of the same shape. The test has the further advantage of being speedily carried out.

CORROSION OF CONDENSER TUBES.

The general problem of corrosion of condenser tubes may be conveniently regarded from four different standpoints :— (1) The arrest or prevention of corrosion in condensers as at present constructed. (2) The treatment of tubes of accepted composition. (3) The general design of condensers. (4) The utilisation of more suitable alloys than those at present in use. The provision of steel protector plates and cast-iron water-ends has proved satisfactory in checking the rate of deterioration, provided that good connections are secured, but at the same time considerable wear of the cast-iron ends takes place, and this wear, if excessive, is an undesirable feature. The present marine practice is to make the tubes and tube plates of as nearly the same composition as is practicable and to secure steel slabs direct to the tube plates, but from the foregoing remarks it cannot be said that this practice is entirely effective. The Cumberland process has been fitted in certain vessels, but experience gained has not been sufficient to allow of any reliable conclusions being drawn. With regard to the treatment of working tubes, the British Admiralty (acting on a well-known and successful practice of coating corroded copper pipes with a film of pitch and marine glue) have experimented with resistant varnishes. Experience has been confined to two vessels. In one case the treatment was a failure, but it is understood that in the other case general corrosion, which formerly resulted in comparatively frequent failures, has been entirely arrested. The protective value of an oxide film is being tested. In regard to the elimination of failures caused by surface defects, e.g., spills, a vessel has been fitted with compound tubes made on the lines suggested by Sir Charles Parsons, but here again it has not yet been possible to obtain any conclusive results. The general design of condensers has been found to be closely connected with tube defects, or, rather, with the acceleration of deterioration, and in particular in regard to certain designs where the whole of the tubes are not drowned. Experience to date has shown that the tubes made to Admiralty specification have proved the most satisfactory under the varying conditions imposed by naval service. These particulars summarise the evidence recently placed before the Institute of Metals by Engineer-Lieut.-Commander G. B. Allen, R.N. They treat of an important matter, as condenser defects have become of paramount importance in view of the sensitiveness of the present type of water-tube boiler to the quality of feed supplied.

OIL FUEL ATOMISERS.

Manufacturers of equipment for utilising oil fuel offer the following suggestions for the selection of atomising burners :—The burner must not carbonise. A burner that

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Alum
Alum Sulphate
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Benzol
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Caustic Soda
Coal Tar
Copper, Acetate
Copper, Iodide
Copper, Nitrate
Copper, Sulphate
Cresols
Dry Felt Fibre
Glucose
Glycerine
Hair (Manufactured)
Lubricating Greases
Molasses
Motor Spirit
Naphthas
Naphthalenes
Oils: Anthracene
Blastfurnace Creosote
Coal Tar Creosote
Essential
Fuel
Fusel
Fish
Gas
Green
Lubricating
Paraffin
Petroleum
Oils: Whale
Paints
Pitches
Red Lead
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carbonises should be scrapped at once, as it is not dependable, is wasteful of oil, and requires a great deal of care and attention. The oil and steam orifices should be independent of each other, so that excessive oil pressure is not required, and in order that no cutting effect is produced when burning oil containing residuum or sand. The burner should be so constructed and filled that it will produce a flame of sufficient length and width to fill the combustion chamber of the furnace or firebox of boiler. The oil orifice should be large enough to permit free exit of heavy oils and tars therefrom, and the atomiser opening should be as small as possible.

PERSONALIA.

We regret to announce the death of Sir William Mather, in his 83rd year. He was educated in Germany, and on completing his educational course entered the Salford Iron Works, owned by his father in conjunction with Mr. Platt. At the age of 24 he was taken into partnership, and before he was thirty-three he had the management of a business that was to expand rapidly under his control. In 1877 he became the sole proprietor, on the retirement of the elder partners. In 1892 the firm of Mather and Platt was converted into a limited company, with Sir William as chairman, and in 1899 it was reconstructed to permit of amalgamation with Dowson, Taylor and Co., Ltd. In 1893 he established the eight-hour days throughout his works, well in advance of other manufacturers. He was a member of the Institution of Civil Engineers, the Institution of Mechanical Engineers, and the Iron and Steel Institute. Sir William was created a Knight in 1902 and a Privy Councillor in 1910.

THE death has occurred in Glasgow of Major D. T. Jenkins, V.D., who since 1915 had been manager of the Glasgow Iron and Steel Company's works at Wishaw. Aged 62 years, Major Jenkins was a son of the late Mr. T. Jenkins, J.P., Dowlais, and for over a quarter of a century prior to his departure for Wishaw he was head of the steel department at Messrs. Guest, Keen & Nettlefold's works in Dowlais.

MR. J. TAYLOR, senior partner of Messrs. John Taylor and Sons, the mining engineers, chairman and director of a number of mining and other companies, left £19,340.

The gross value of the estate of the late Mr. Henry Greenwood, of Greenwood and Batley, Ltd., Leeds, is £36,863.

Mr. W. Clark, director of the firm of Vickers, Ltd., has been elected new Master of the Cutlers' Company, Sheffield.

Mr. J. Hamilton has resigned from the board of directors of the Fairfield Shipbuilding and Engineering Co., Ltd.

TRADE NOTES.

The directors of Palmers Shipbuilding and Iron Co., Ltd., announce:—Profit, £317,180; less debentures and loan interest, £92,161; brought forward, £22,876; interim preference and ordinary dividend, 5 per cent., £2,500; sinking fund for 1908 5 per cent. debenture stock, £6,000; further preference and ordinary dividend, 7½ per cent., making 12½ per cent. for year, £78,750; dividend on new shares, 7½ per cent. for half-year, £30,340; reserve against investments, £50,000; carried forward, £30,306.

The accounts of the Pearson and Knowles Coal and Iron Co., Ltd., show an available balance of £329,916, disposed of as follows:—Interim ordinary dividend, 5 per cent., free of tax; final dividends, 3 per cent. on first preference, 3¼ per cent. on second preference, less tax, and 5 per cent. on ordinary, free of tax, making total distribution £132,615 for year; reserve fund, £96,000; carried forward, £101,300.

Sheepbridge Coal and Iron Co., Ltd., announce a profit of £184,039; brought forward, £33,374; interim dividend paid, £33,463; disposal, £183,950; final dividend, 7½ per cent., making 10 per cent. for year, free of tax, £100,399; reserve fund, £50,000; carried forward, £33,561.

Partington Steel and Iron Co., Ltd., show:—Profit, £171,691; brought forward, £10,737; disposable balance, £182,429; ordinary dividend, 10 per cent. for year; reserve, £100,000; carried forward, £26,429.

The accounts of Stothert and Pitt, Ltd., of Bath, show profit, £34,092; available, £28,630; further ordinary dividend, 7½ per cent., free of tax, making 12½ per cent., free of tax, for year.

Dobson and Barlow, Ltd., the textile machinists of Accrington, show a profit in their accounts of £91,252; final dividend, 10 per cent., making 15 per cent. for year; reserve, £30,000.

P. and W. Maclellan, Ltd., of Glasgow, announce an ordinary dividend of 14s. per share, less tax.

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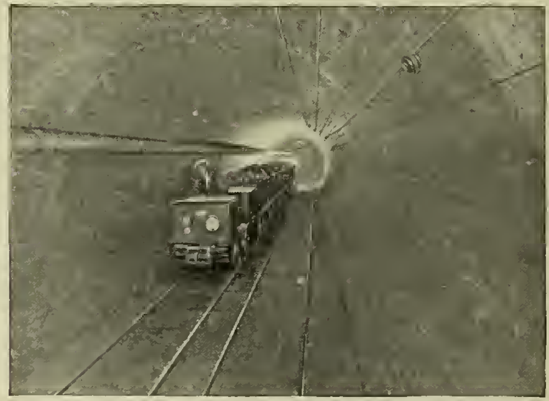

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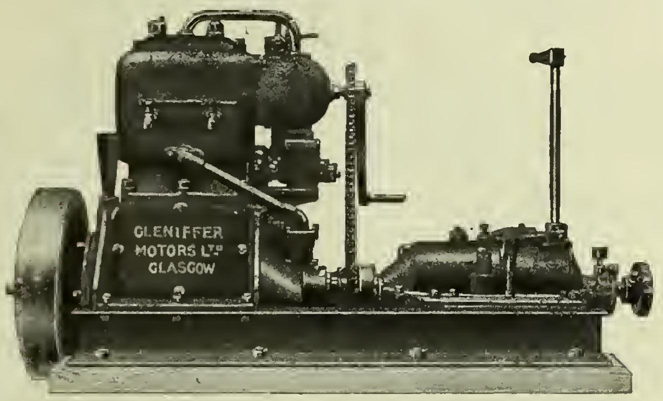

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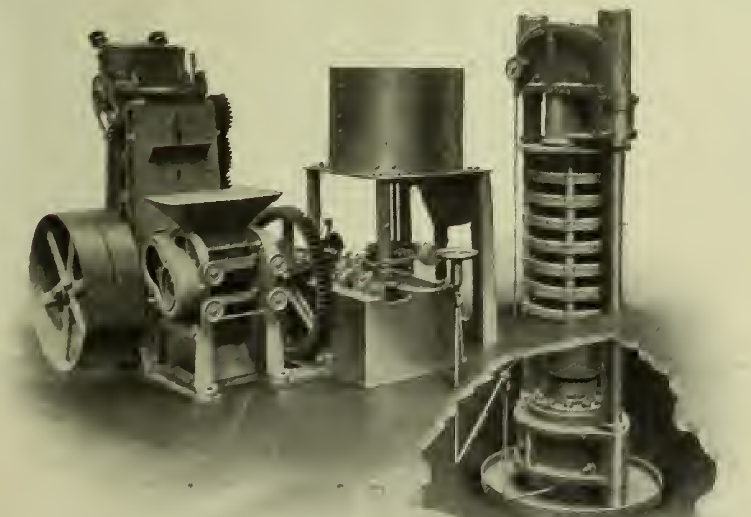

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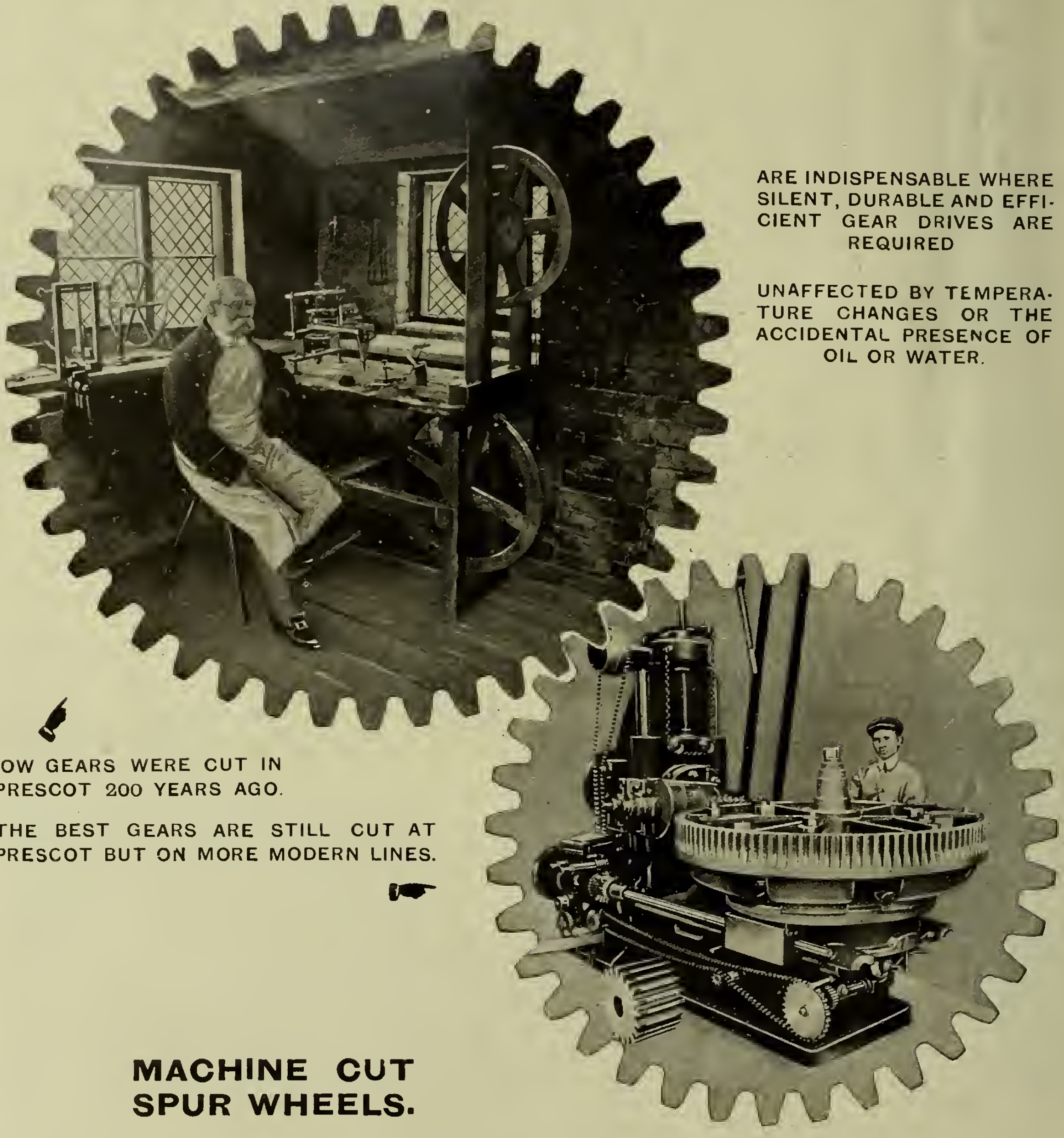

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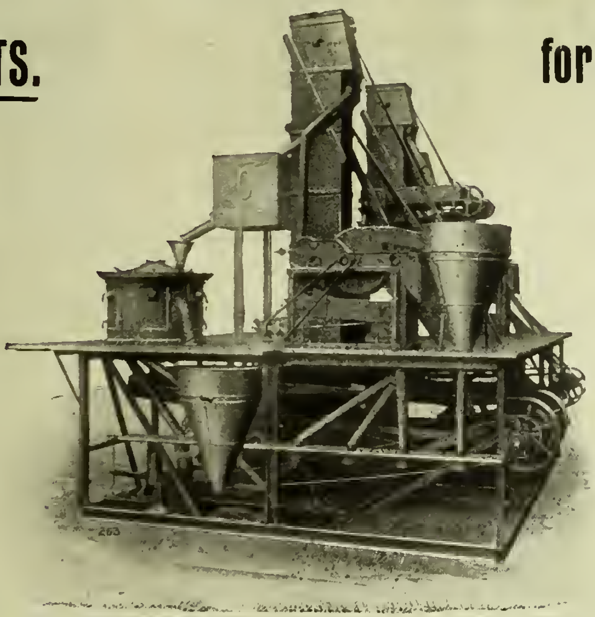

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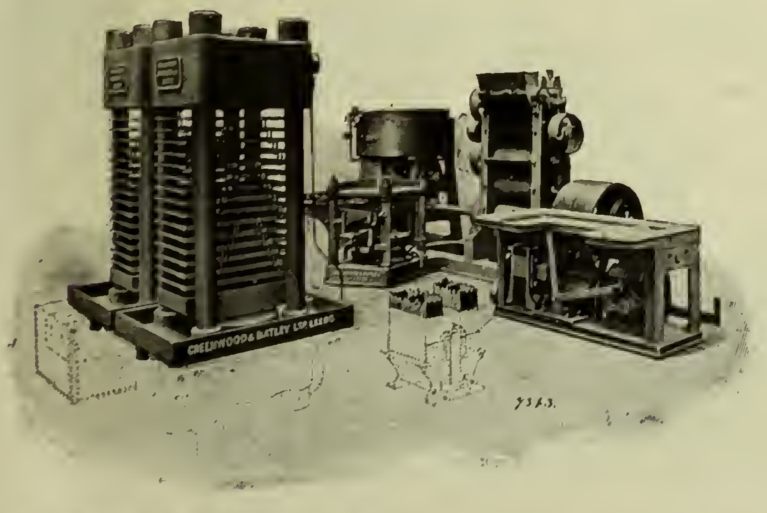

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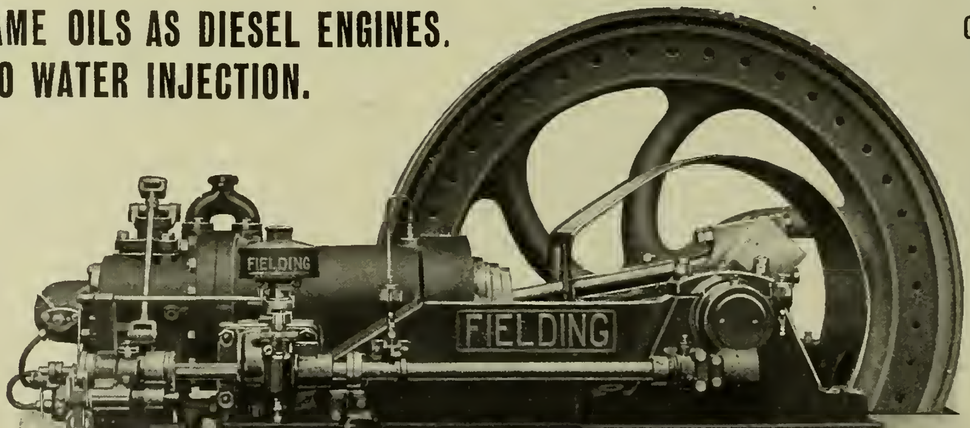

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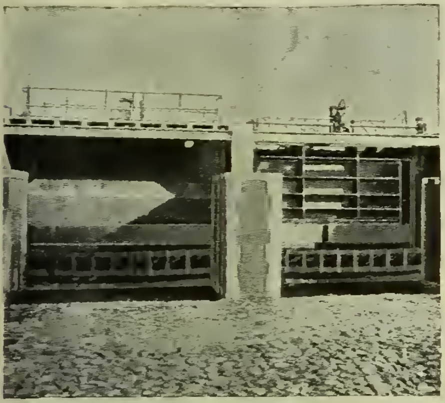

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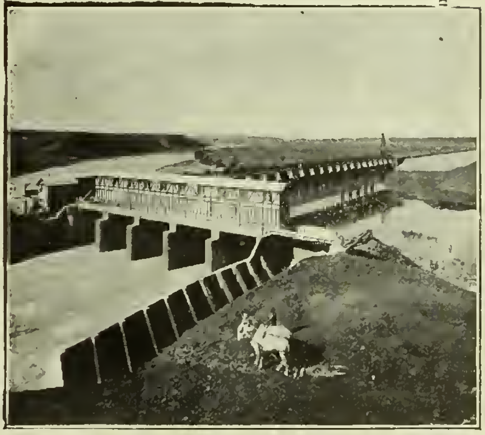

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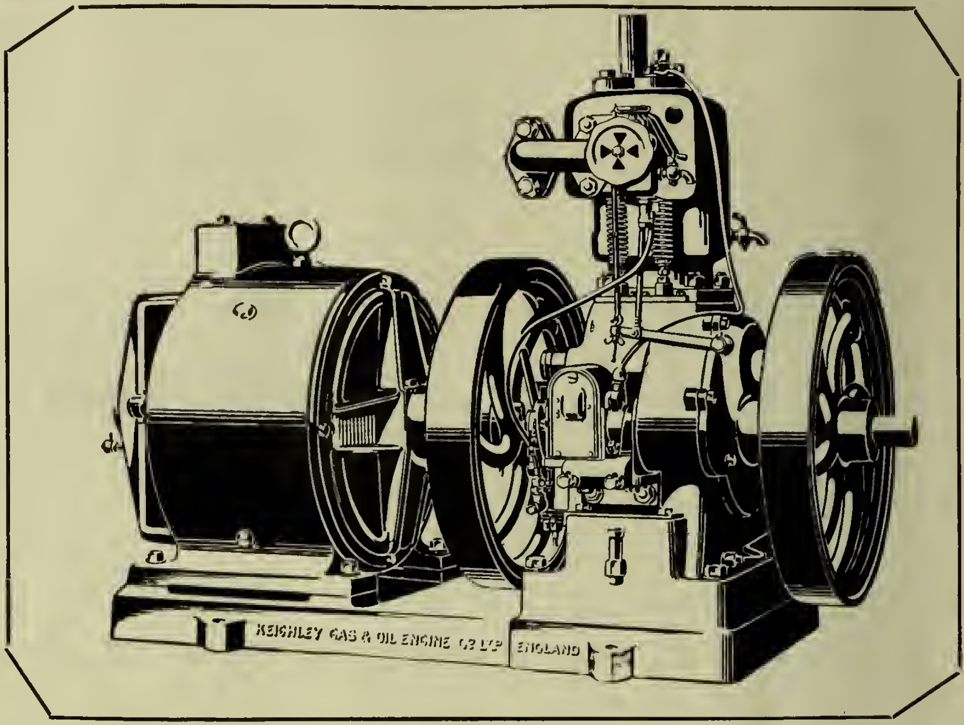
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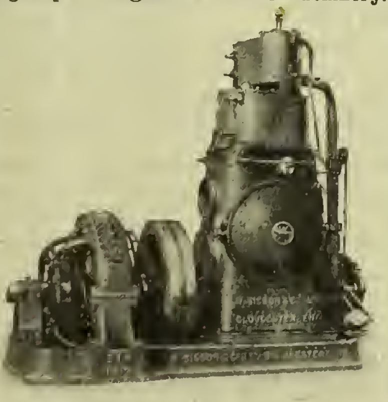

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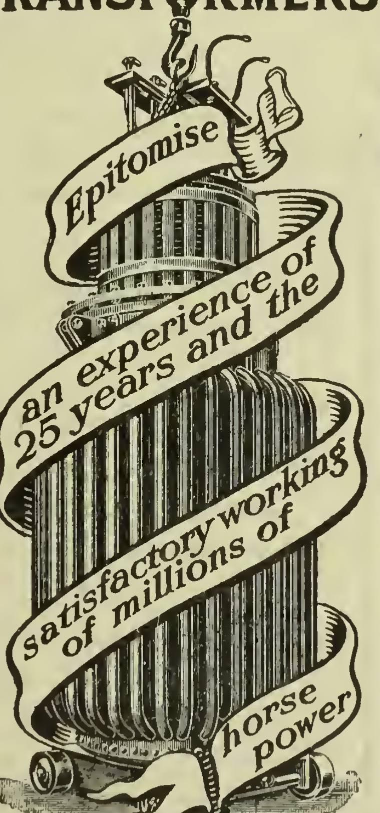

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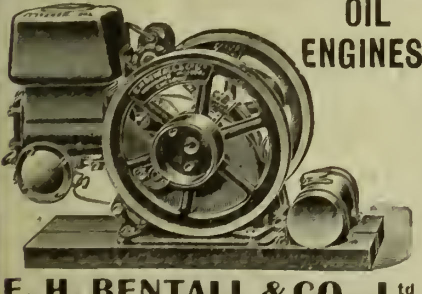

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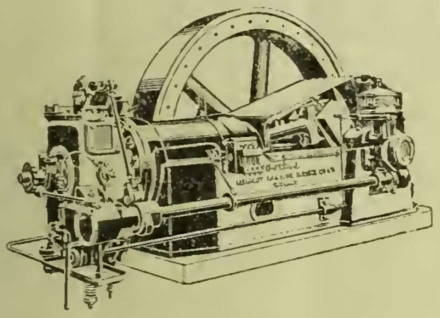

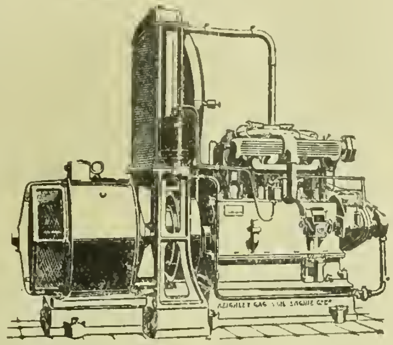

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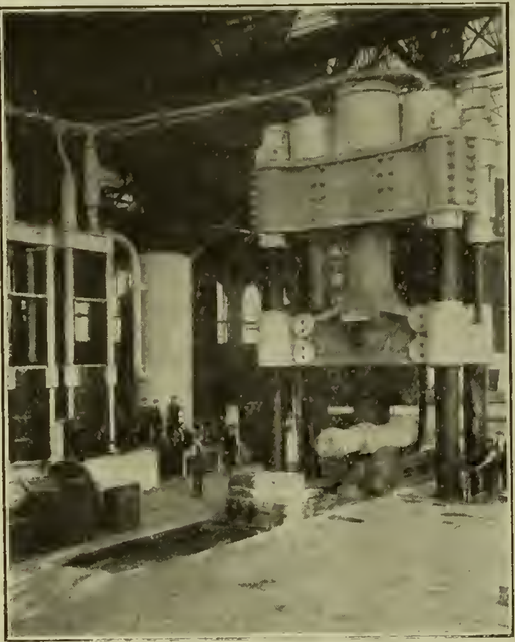

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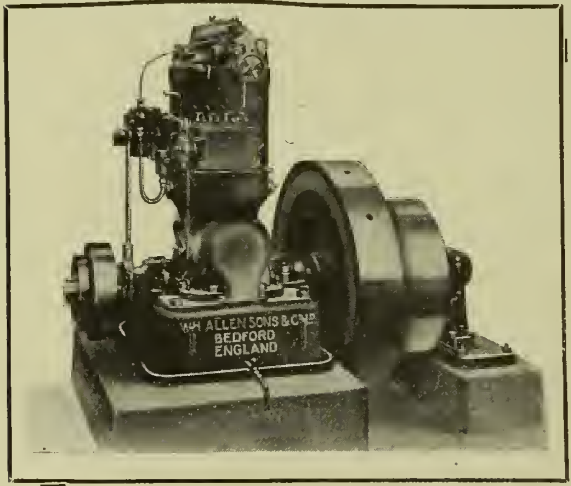

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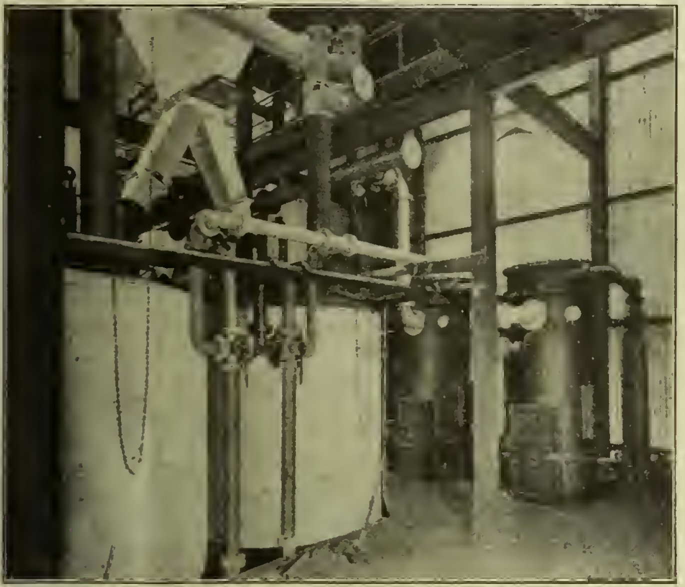

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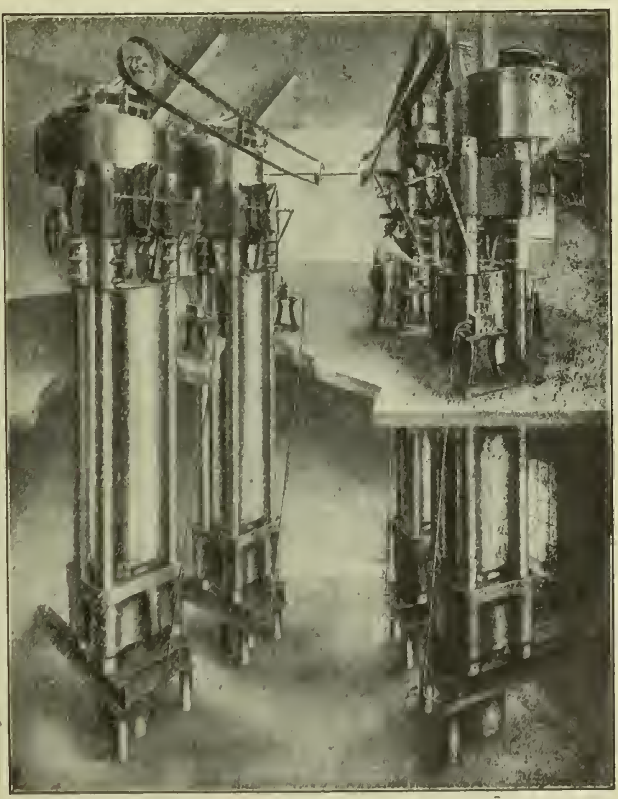

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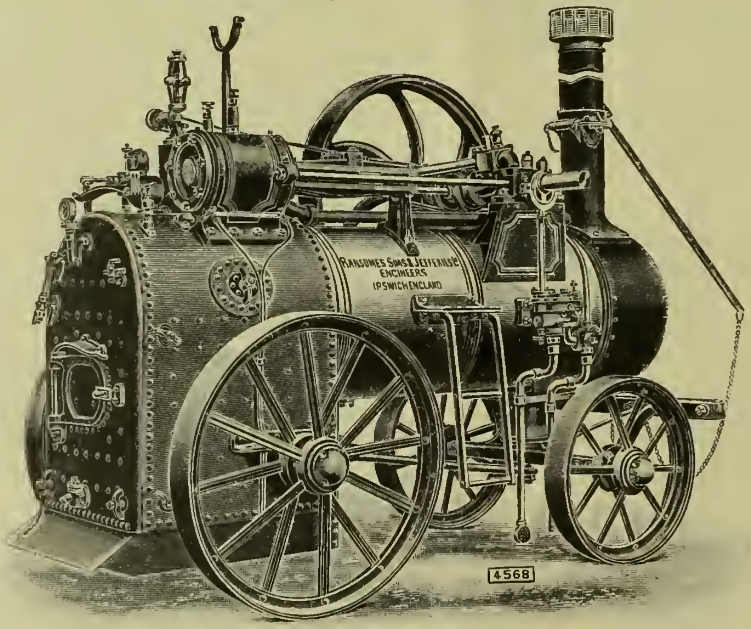
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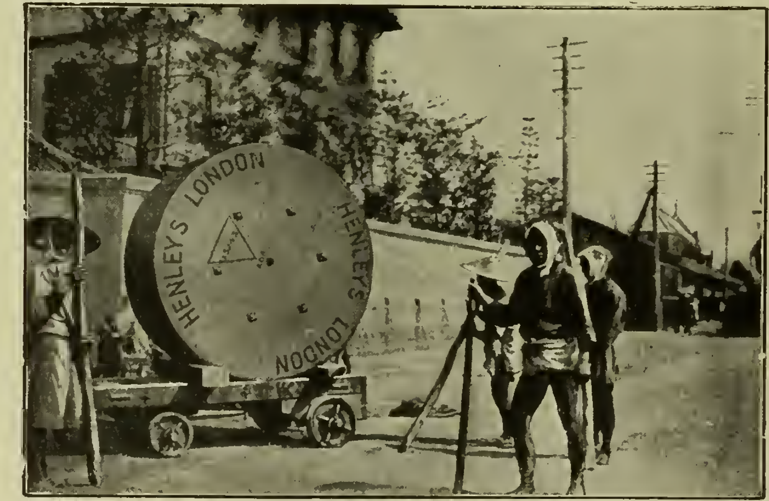

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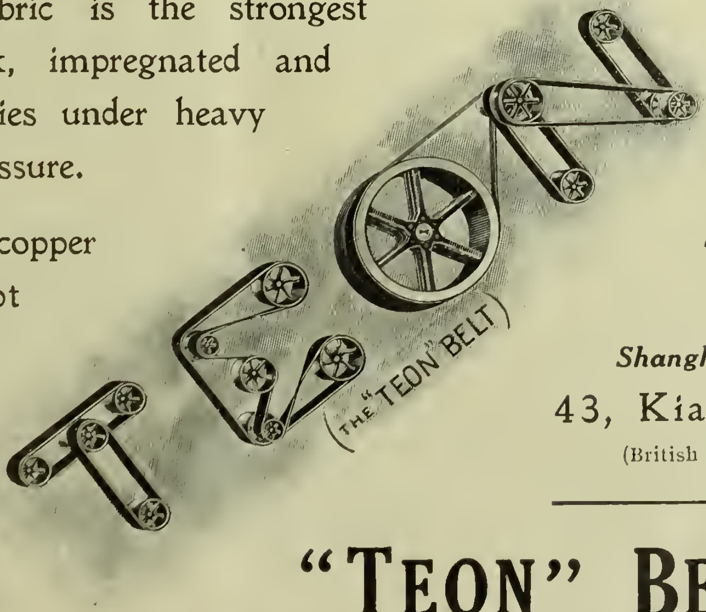

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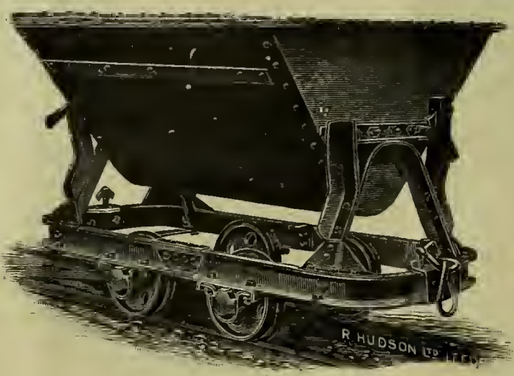

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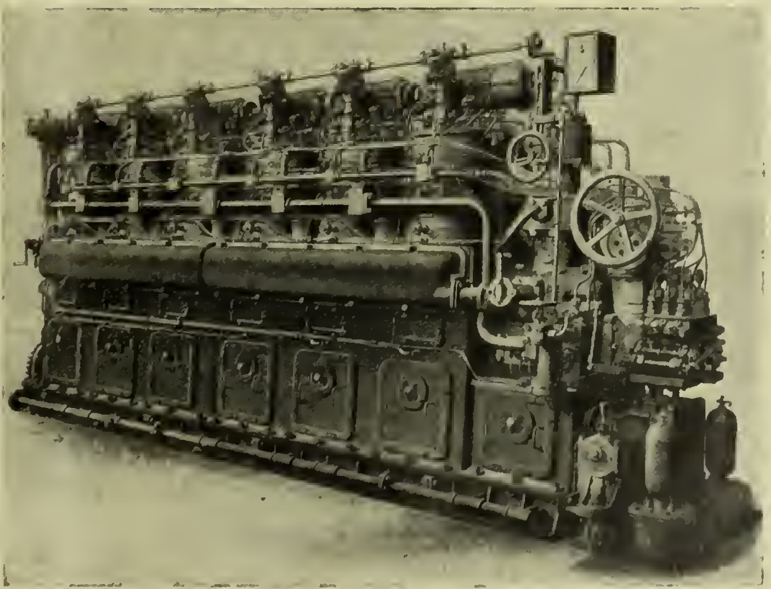

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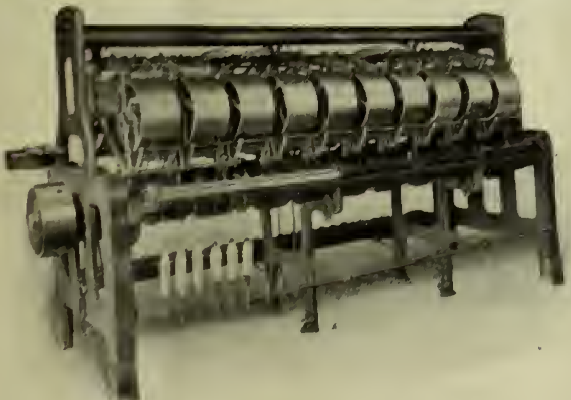

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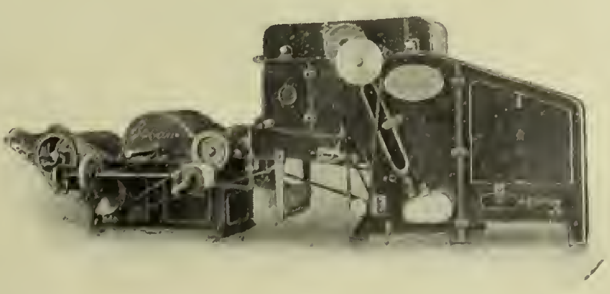

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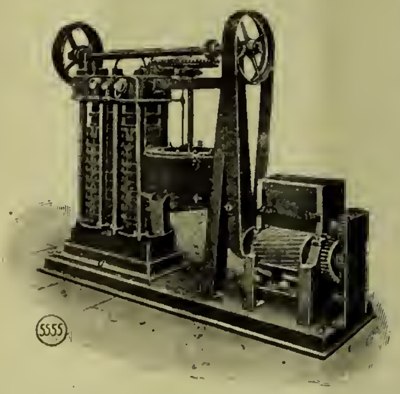

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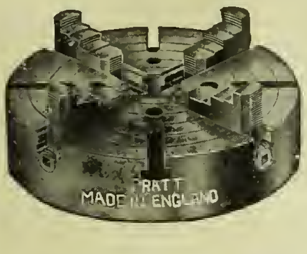

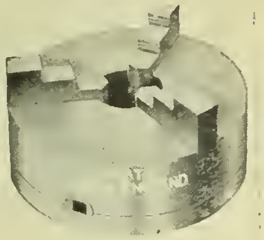

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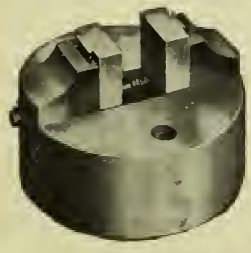

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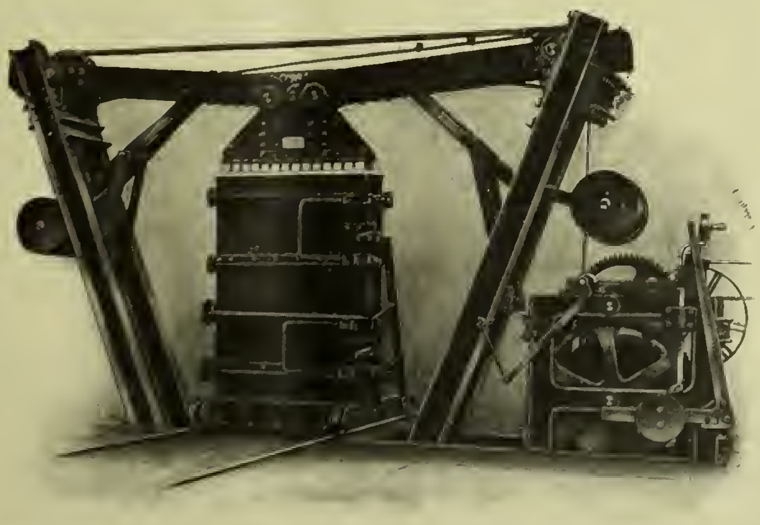

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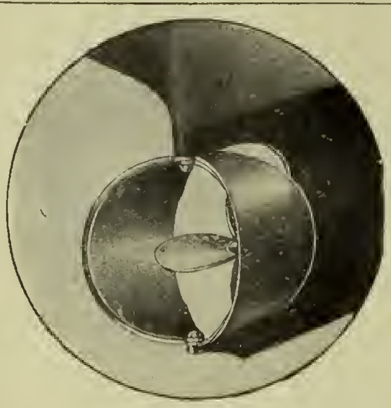

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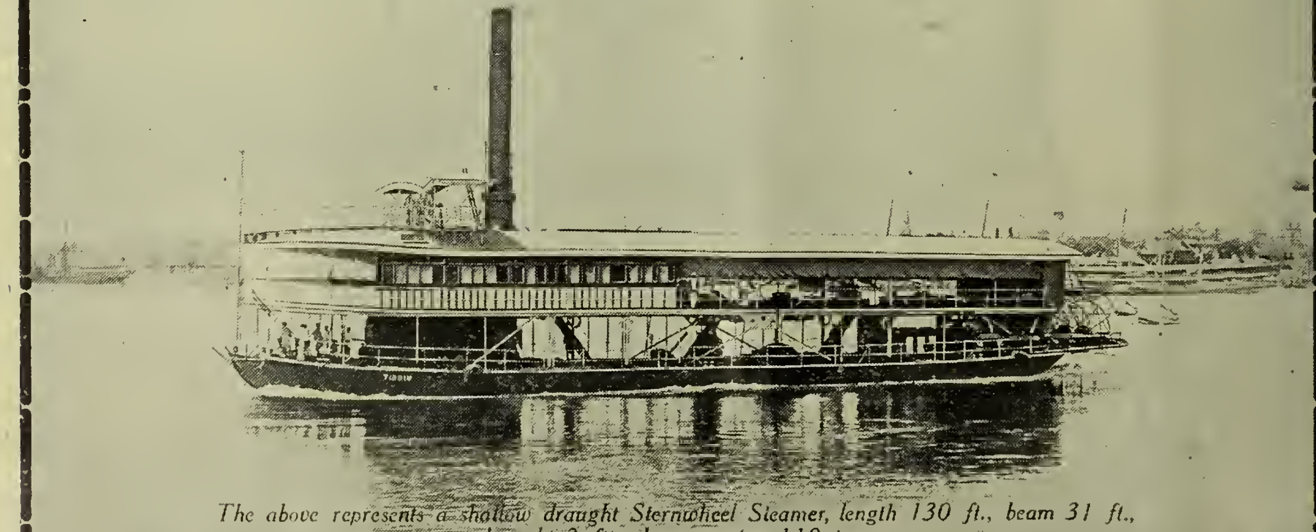

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EASTERN ENGINEERING

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NOTES AND COMMENTS.

AVIATION DEVELOPMENTS.

During the month an official Air Conference has been held in London, at the Guildhall, and all branches of aviation are the sounder for the frank admissions and expert opinions submitted. It is evident that commercial aviation in Great Britain is not likely to succeed unless accorded special aid. This may take the form of a Government subsidy, or, as we should prefer to see it, the carriage of the whole of the Continental mail may be placed with the aviation transport companies, and the industry thus given the necessary backing. Some such measure is as necessary as it is advisable at the present stage, and there is little doubt such aid will be forthcoming. The advantages to be found in the development of aerial transport justify it, and the importance of such development from a military point of view—which is omnipotent when aviation matters are considered—allows of no alternative. The technical recommendations and disclosures made at the conference certainly compel attention, though they may not bring with them conviction as to their efficacy. The statement made that, because of the rise in the cost of petrol, it may be necessary to replace the petrol with some form of steam engine was probably the most striking development mentioned during the proceedings. The development of aviation has only been rendered possible by the development of the petrol engine. Eliminate this factor in aviation, and the progress we have made does not carry us very far. It is difficult to realise how steam can be employed—commercially, at least—except for very short flights. If such a development be possible, then it can hardly fail to affect all forms of transport and industry as a whole. To such it will be of more value than to aviation. If scarcity and high cost of petrol are the difficulties before aviation, one would have looked for a solution in the rapid development of those schemes now under consideration for the production of power alcohol, which promise industry unlimited supplies of fuel. We are glad to note Air Conferences are to be held annually. By such means the problems which confront commercial aviation can best be handled.

POWER ALCOHOL.

In the light of the comments just offered, it is satisfactory to note that much is being achieved in the search for new motor fuels. An encouraging statement on India's potential supplies of fuel from vegetable alcohol was recently made by Sir Charles Bedford at the Royal Society of Arts, in London. The potentialities of India, and especially of the deltaic areas in Bengal and Burmah, are said to be unrivalled even by China. The Government of India is showing due recognition of the importance of these possibilities. A Committee has been appointed to study bulk storage and transport conditions, and Sir Charles has left for India to renew his investigations. The question of motor fuel from waste vegetation was considered at length at the recent Imperial Motor Transport Conference, just held in London. The development and cultivation of areas on estates to ensure a local supply of fuel was strongly urged, and a system of co-operation between the agriculturist and the distiller was proposed. The scope for development was well illustrated by one speaker, who mentioned an area in British East Africa, of comparatively small dimensions, which, if planted with the right crops, would produce an amount of alcohol that would displace the petrol used throughout the British Isles. Representatives have already been dispatched to certain territories to consider whether the material could be produced for alcohol at an economical figure. Valuable experiments have been conducted at the Manchester University in comparing alcohol with petrol as a fuel. Alcohol has most of the qualities required in a motor fuel. It has lower calorific value than petrol, and can be used under greater compression. Even the admixture of 20 per cent. of benzine, which is convenient in starting from cold, does not materially lower the high ignition temperature under compression. The initial disadvantage of alcohol is that it gives off vapour very slightly at low temperature. It is possible to overcome this by spraying alcohol into the cylinder and warming it by compression. But alcohol can be most conveniently used with a 20 per cent. mixture of benzine. Experiments have been conducted by the London General Omnibus Company with a benzole-alcohol mixture, and show ease of starting, acceleration, flexibility, and pulling at low speeds, and an absence of engine knocking when negotiating hills at low speeds. Some 4,500 miles were covered at an average speed of seven miles per gallon. Where an alcohol fuel is on the market a large demand has been met, as instance the case of "Natalite"—the substitute for petrol in use in South Africa, recently described in this journal—where the manufacturers are now endeavouring to cope with the demand by installing additional plant.

ENGINEERING DEVELOPMENT IN GREAT BRITAIN.

H.M. Chief Inspector's Report on Factories and Workshops for 1919 gives, as usual, a clear idea of the extent and trend of engineering development in Great Britain. The rapidly extending use of electricity in industry is the outstanding feature of the report. The existing generating stations in many districts have been quite unable to cope with the rapidly increasing demand despite extensions of power houses. Many millowners in the woollen and cotton districts who could not be persuaded before the war to adopt electrical driving are now clamouring for it. The report draws attention, as it did last year, to the increased use of electricity for heating metal furnaces and for welding steel castings. Reference is also made to the installation in one large iron mill of electrical plant for driving a large reversing rolling mill requiring 2,500 to 8,500 horse-power. Many large and excellently equipped factories have been built during the period under review. Since 1914 the number of factories has increased by 12,396, and there has been a decrease of 8,060 in the number of workshops, due to the gradual closing down of country workshops and an extensive conversion of town workshops into factories, largely by the installation of electric power. The report as a whole makes satisfactory reading in view of the pessimistic outlook for British trade presented in certain quarters. The demand for commodities, which in 1919 induced manufacturers to reach out in all directions for increased manufacturing facilities and assured activity for a very long time to come, must, it is imagined, be quickly regained with more settled labour conditions. The report states that conspicuous growth was shown in shipbuilding and repairing, also in the motor vehicle industry. Standardisation and specialisation appear to be the order of the day, together with mass production and the increased use of labour-saving machinery.

EXPORT CREDIT SCHEME.

Some little time back particulars were given in these pages of the Board of Trade Export Credit Scheme to foster foreign trade. The principle was that the Treasury should advance 80 per cent., for a period of up to three years, of the cost price of the goods to be supplied, leaving the balance to be advanced by bankers of the manufacturing firm wishing to export. Measures are now being taken, under the auspices of the Federation of British Industries, that the scheme should provide for advances to approved firms of 100 per cent. It is pointed out, moreover, that the policy under the scheme is to oblige the exporter to finance 20 per cent. of the net cost price of the goods that it is intended to export. Granted that the bankers—or, if the suggestions are accepted, in future the Treasury—will provide the 20 per cent., the exporter is still forbidden to cover this risk by means of insurance. It may be argued that this obligation ensures the exporters only taking on sound business, inasmuch as business which is good enough for the Treasury to finance to the extent of 80 per cent. should be good enough for the profiting firm to finance to the extent of 20 per cent. But it is now strongly urged the Board of Trade agrees to the exporter being allowed, if he desires, to cover himself by insurance. So far as certain Continental countries are concerned, the Government has now agreed to advance up to 100 per cent., and manufacturers are promptly availing themselves of such improved facilities.

SHIPPING IN THE UNITED STATES.

In America, and, to a small extent, in Great Britain also, there is a falling off in merchant ship construction, due to increased cost of construction. Even approximate prices and dates of delivery are difficult to obtain. These difficulties are more pronounced in the case of repair work than for new tonnage. In Great Britain, and likewise in the States, more settled labour conditions are predicted in the near future, and the position is viewed with comparative confidence. In America plans are very generally being considered for securing greater economy in construction, and for utilising to a very much greater extent than hitherto the economies which the marine oil engine renders possible for shipowning interests. In view of the far-reaching measures which have been taken to support United States shipping, interest attaches to the statistics regarding the operations of the vessels of the United States Shipping Board recently published in Chicago by Admiral Benson. These show that for the twelve months ended June last the vessels carried exports of 13,379,000 tons, and imports of 7,236,000 tons, a total of 20,615,000 tons. Of the total foreign trade of the United States during the fiscal year, 57 per cent. was carried by American vessels—29 per cent. by Shipping Board and 28 per cent. by Independents. The tonnage of active vessels at present controlled by the Shipping Board is distributed to the extent of 38 per cent. in North European trade, 17 per cent. in Transpacific, and 15 per cent. in South American trade. The total documented sea-going merchant marine of the United States (500 gross tons and over) at October 1, 1920, consisted of 3,482 vessels of 11,708,342 gross tons. Of this total the Shipping Board now owns 1,627 vessels, 693 of which are vessels of less than 5,000 d.w. tons each. Vessels between 5,000 and 6,000 d.w. tons number 147, or 771,734 d.w. tons.

REPORT OF LLOYD'S REGISTER OF SHIPPING.

The report of Lloyd's Register of Shipping for the twelve months ended June last gives an expert and most valuable review of shipbuilding, both in Great Britain and abroad. The countries in which the great bulk of new tonnage has been built are the United Kingdom, America, and Japan. Of the total, 2,009,495 tons were built for the United States (1,735,318 tons being for the United States Shipping Board), while the tonnage built for the United Kingdom was 1,234,917 and for Japan 444,957. The great amount of re-conditioning work undertaken after the war, and the conversion of vessels to burn oil instead of coal, have undoubtedly had the effect of limiting the output of new tonnage. The vessels of great size which were lost during the war have not yet been replaced, the more urgent demand being for the replacement of general cargo vessels. With a view to expediting the approval of plans, and at the same time enabling shipbuilders and owners to discuss the scantlings and arrangements of new vessels, and following the successful policy already adopted in America and France, experienced surveyors have been appointed by the Society for Japan and elsewhere to approve on the spot plans in accordance with the Society's regulations. During the year the Society's Chief Surveyor visited Japan, China, the Straits Settlements, and India, whilst the Committee in London had the pleasure of entertaining Baron R. Kondo of Japan, President and Managing Director of the Nippon Yusen Kabushiki Kaisha. During the twelve months under review the Society conducted investigations, and instigated proposals on many important matters, including the sub-division of passenger vessels, the storage of oil on ships using oil fuel, bilge pumping arrangements on passenger ships, experiments on riveted joints, the standardisation of marine boilers, and rules for electric fittings on board vessels, etc. A feature of the report is the development it shows in motor shipbuilding, which is treated at length elsewhere in this issue.

CLASSIFICATION OF ENGINEERS IN AMERICA.

The United States Engineering Council is taking measures for securing recognition of the classification and compensation of various engineering positions. By the term "compensation," salary or remuneration is, of course, intended. The system is to be applied to 23 branches of engineering. From all points of view the movement is praiseworthy. It will go a long way to secure greater efficiency and to remove the discontent which is so often characteristic of professional engineering circles. At present, positions calling for the same qualifications are often subject to wide variations in scale of remuneration, and there is really no standard to be taken as a guide. Very similar conditions obtain, and a similar remedy is called for in practically all countries where engineering really constitutes an industry. The measures which are being carried out in America are likely to help in setting a standard elsewhere and to exert a beneficial influence wherever engineering activities are conducted. The development in the States is being conducted by the Committee on Classification and Compensation of Engineers. An instance of the system of classification proposed is shown in the case of civil engineering, which will include the following grades: Chief engineer, engineer, senior assistant engineer, assistant engineer, junior assistant engineer, senior aid (office), senior aid (field), aid (o. and f.), junior aid (o. and f.). The professional services grades begin with the junior assistant engineer.

ENGINEERING, MINING AND INDUSTRIAL PROJECTS IN THE FAR EAST.

NAGASAKI HARBOUR IMPROVEMENTS.

The proposed harbour improvement works at Nagasaki recorded recently in these pages include the following contracts:—

(1) To fill in the foreshore at Deshima for a length of 230 ken (1,372 ft.) and an average breadth of 26 ken (147 ft.), and to build a quay wall 14 ft. above low tide at which two steamers of 8,000 tons, or three of 5,000 tons, can moor. At a later date the railway line (now nearly a mile distant) is to be connected, and warehouses are to be built on the reclaimed ground.

(2) To dredge to a depth of 30 ft. in front and in the neighbourhood an area of 100,000 tsubo (about 400,000 sq. yards), thus adding a third to the available area of this depth in the inner harbour.

(3) To build a landing stage by the station, to enable goods to be loaded direct from the railway trucks to lighters.

H.M. Consul at Nagasaki reports that these works are estimated to cost one and a-half million yen. Of this the Government is to pay one-half, the other half will fall upon the city. The exact manner in which the sum is to be raised has not yet been decided. The work is to occupy three years, and will necessitate increased railway communications if full benefit is to be secured from the improvements.

PROPOSED ELECTRIC TRACTION EXTENSIONS AT YOKOHAMA.

An application has been sent to the Yokohama Municipal Office by the Yokohama Electric Car Company for permission to extend the electric car line by a double track from Honmoku to the Yawatabashi terminus along the shore. The cost of the new enterprise is 1,600,000 yen, including 459,475 yen for rails and 130,650 yen for the reconstruction of the Yawata bridge.

METEOROLOGICAL STATIONS FOR JAPAN.

The Marine Observatory of Kobé, on Ujinoyama, on which the Kobé Meteorological Observatory also stands, has now been completed, and it is reported that the authorities will establish two more fully-equipped meteorological observatories in Japan—one at Kobé and the other at Fukushima.

STEEL FROM VOLCANIC IRON SAND.

Advices from Tokyo state that a project is under consideration for exploiting a method of utilising volcanic iron sand for the manufacture of steel, which, if adopted, it claims would make Japan independent of imports. It is added that the recurrent anti-Japanese movements in China since the signing of the Treaty of Versailles forced Japan to seek a means of securing an adequate home steel supply. Experiments were begun in September last with iron sand, of which there are unlimited supplies in the country, and tolerably good results were obtained from practical experiments at the Penchihu blast furnace. Although the discovery is successful from the military point of view, the statement concludes, this does not necessarily mean that it ensures any economic advantage.

MOTOR BOATS FOR FORMOSA.

Since Formosa has been occupied by Japan a great impetus has been given to the fishing industry, and an important potential and actual demand for vessels has developed. Motor boats are used for catching bonito and tunny, which are found in great abundance. There are some 380,000 Japanese vessels engaged in the fishing industry in Far Eastern waters. About 1,400,000 people are employed, and the value of the products obtained amounts to 120,000,000 yen annually.

DAIREN WATERWORKS SCHEME.

A sum of 4,681,380 yen has been set aside by the Kwantung Government for the extension of the Dairen Waterworks. This expenditure will be spread over five years. With the completion of this work there will be available 20,000,000 tons of water, sufficient to supply a population of 300,000 persons. It is stated that the source of supply is to be at Lung-Wang-Tang, 22 miles from Dairen, where a reservoir is to be built, covering some 93 acres, with a depth of 120 ft. The electric power house, of 1,200 kilowatt capacity, for pumping the water to Dairen, is to be established in Port Arthur, though, of course, the pumps themselves will be at Lung-Wang-Tang. The main pipe will be of 18 in. and the supply pipes of 16 in. diameter. Details of costs are as follows:—

	Yen.		Yen.
Reservoir	1,524,400	Buildings	18,500
Pumps	84,000	Setting main pipes	631,000
Power house and transmission of power to reservoir	314,000	Tunnel work	255,000
Machinery	100,000	Setting supply pipes	1,184,500

AMERICAN ELECTRICAL TRADE PROJECT IN CHINA.

Reuter's Trade Service announces from New York that the American Western Electric Co. is fitting out a house-boat at Shanghai, which will make a tour of the rivers and canals of China this winter. The boat will contain practically all the latest electrical labour-saving devices to be found in American homes. It will carry a complete line of household devices, including motor-driven sewing machines, vacuum cleaners, irons, and washing machines, as well as the labour-saving electrical apparatus used by American farmers.

SHANSI UNIVERSITY EXTENSIONS.

Under the progressive administration of Governor Yen and through the successful negotiations of Mr. H. Wong, a graduate of the Imperial College of Science and Technology, South Kensington, London, and Dean of the Engineering Department of the Shansi University, additional funds, $50,000 for the rebuilding of the Engineering Department and $20,000 every year for equipping the same, have been granted to the University. The new building will be built entirely in Western style, and was expected to be completed at the beginning of November this year. It is hoped that in five years' time this department will be equipped fully along up-to-date lines and become one of the best educational institutions in North China.

DEVELOPMENTS IN FRENCH INDO-CHINA.

The Agence Générale des Colonies, Pièce 21, 2e étage, 27, Rue Oudinot, Paris, is calling for tenders for generating station at Gia-Lam, French Indo-China; pumping station at Dong-Du, on the Red River; and for electric line between above stations. The installation of a power station is contemplated at the Falls of Chobo, on the Noire River, Indo-China. Some 50,000 h.p. is estimated as available, which, after supplying 5,000 h.p. to a zinc works, will provide power for irrigation in the lower reaches of the Rouge River, the surplus being distributed to local industrial consumers.

INDUSTRIAL PROJECTS IN SUMATRA.

The Agricultural Economics Section of the Netherlands East Indian Government draws attention to the possibilities for industrial development in Sumatra. Tea plantations are promising at an elevation of 2,000 ft. or over. Many requests have been made to the Government for plantation land. In the newly-developed Mauru Lubah district coffee is the chief product, and in this locality both rubber and tea promise good returns. Transport presents difficulties, and much is expected from the projected railway and motor road to Padang. Rapid industrial development will probably be witnessed on the southern slopes of Mounts Korintji and Tudjuh when transport facilities are provided.

A road from Sungei Penuh to Tapan is in course of construction. Transport by river will be possible from Indrapura to Pasir Ganting on the coast, and from thence by sea to Padang.

Grants for leasehold land to the extent of 50,000 bouws are under consideration. The soil up to a height of 4,500 ft. is rich, and prospects for tea and cinchona are good, the only drawbacks being transport and labour.

In the Djambi Highlands large areas of land suitable for rubber and oil-palm plantations are available. The soil is good, and the rainfall, though not heavy, is, nevertheless, regular, though the district lacks roads and population. Owing to the scarcity of labour and the food difficulties it would seem that only large enterprises have a chance here, but as soon as a railway is laid down and the roads put in good order smaller estates will be placed on all fours with the bigger concerns.

The territory of Muara Bungo can best be developed first without too great expense. It is expected that the districts on the slopes of the Sumbing and Mesurai mountains will also offer good opportunities for high land cultivation.

Projects are likely shortly to come under consideration for the development of the coal concession in Sumatra. from which it is anticipated some 150,000,000 tons of good furnace coal can be obtained. As a result of the linking up by rail and motor of Telok, Betong, Palembang, and Benkolen, the demand for articles of British manufacture steadily continues to increase. The schemes in hand for water-power installation have been set out in recent issues of this journal, and offer valuable openings for industry and capital.

GOVERNMENT SUPPORT FOR TRANSPORT AND AGRICULTURAL PROJECTS IN NETH. INDIA.

Great development of transport facilities is taking place in the Netherlands East Indies, and a sum of £20,000 has been set aside in the Budget for the purchase of motor lorries and cars for Java and Sumatra. Further than this, a considerable sum is to be set apart for increasing the rolling stock of the railways and extending them. Of even greater importance is the fact that the very considerable sum of over £1,000,000 has been estimated for on account of the Department of Agriculture and Commerce. Most of the money will be spent for scientific purposes connected with the Institute for Plant Diseases, the establishment of scientific laboratories, and the better administration of the forests.

DUTCH RUBBER PLANTING DEVELOPMENT.

Further issues of capital are announced by several Dutch rubber planting concerns. The Hessa Rubber Maatschappij, formerly the Hessa Tabak Mij, is increasing its capital from fl.700,000 to fl.2,000,000 by an issue of fl.1,000 shares. The present development of the company's plantations gives promise of a yield of 135,000 half-kg. rubber this year, 260,000 half-kg. in 1921, 400,000 half-kg. in 1922, 520,000 half-kg. in 1923, 650,000 half-kg. in 1924, and 700,000 half-kg. in 1925.

The N.V. Nederlandsch-Indische Rubber en Koffie Cultuur Maatschappij is issuing fl.500,000 worth of ordinary shares of a face value of fl.1,000 or fl.100 each, at the rate of 175 per cent., with participation in current year's dividend. The dividend for 1919 was at the rate of 20 per cent. as the result of a yield of 188,854 half-kg. rubber, 489 piculs Java coffee, 24.501 piculs Robusta coffee, and 114,054 half-kg. cocoa. The yield for the current year is estimated at 202,000 half-kg. rubber, 100 piculs Java coffee, 19,500 piculs Robusta coffee, and 110,000 half-kg. cocoa.

COMMERCIAL PROGRESS IN JOHORE.

The great commercial activity reported in Johore, the most southern of the native States that come within the jurisdiction of the High Commissioner for the Malay States, should create industrial projects of some importance. This is particularly true as regards agriculture. So great has been the recent rush for agricultural land that applications for no less than 750,000 acres have been received, or about one-sixth the area of the State. Most of the applications were, of course, for rubber land, but there was also a demand for a large area of land for the cultivation of African oil palm. At present a causeway is being built to connect the island of Singapore with the mainland at Johore Bahru, at a cost of over £1,500,000. This will carry the railway and will also have a roadway suitable for motor vehicles; thus preparations are being made for an era of even greater expansion, and if only a more plentiful supply of labour were available there could be little doubt that Johore is destined to be one of the most prosperous of the Native States of Malaya.

In 1911 the revenue amounted to £461,405, as compared with £1,283,657 in 1919. The expenditure in 1911 was £404,783; in 1919 it had risen to £959,450, but this latter figure includes expenditure on reproductive public works upon which £395,560 was spent. The State has a balance of assets over liabilities of £1,067,908, of which £632,357 is invested in British War Loan, National War Bonds and Funding Loan. The statistics of trade are equally good. In 1914 imports were valued at £1,014,152; in 1919 they had risen to £3,444,548. Exports were valued at £1,929,135 in 1914; in 1919 they were valued at £8,315,992. The value of the combined imports and exports of this Malay State, opened up in comparatively recent times to foreign trade in any degree of magnitude, now reaches very creditable figures, and there is every appearance of its rapid expansion.

MINERAL RESOURCES OF THE PHILIPPINES AND THEIR DEVELOPMENT.

Statistics recently published by the Division of Mines Bureau of Science at Manila relative to the mineral resources of the Philippines and their development show that the majority of Philippine coals falls under the class of lignite, but there is also a good quantity of the bituminous grade on Polillo Island, and in the Zamboanga district in Southern Mindanao. No work has been done on the Polillo deposit for the last two or three years.

During the last few years there has been comparatively little prospecting and, in consequence, very few discoveries of new coal seams have been reported. The Bureau of Science has an arrangement by which prepared samples from prospects in new territories may be analysed free of charge.

The considerable advance in the local price for imported coal has given an excellent opportunity to open the coal deposits. The Batan field has been re-opened and at present leads in production. The Cebu deposits at Uling and Danao are being developed extensively and have largely contributed to the output. A newly organised company and several small operators are working on the Toledo field. The National Coal Company has leased the Compostela mines, and has started to open the coal deposits at Sibuguey, Mindanao. The demand for Philippine coal has increased its market value. There has been considerable prospecting in the latter part of 1918 near Buruanga, Capiz, and favourable reports have been received regarding the progress of development work. The coal there is intermediate between peat and lignite, but has been successfully used for firing the boilers of some of the inter-island steamers when mixed with firewood.

At the close of 1918 twenty-three mines were producing coal in greater or less quantities. The miners, with few exceptions, are Filipinos; but the supervision is largely in the hands of Americans and Europeans. A modified form of the room-and-pillar system of mining is used by the more developed mines. Coking coal occurs in Cebu Province, but the seams have not yet been proved economically important. The Manila Gas Corporation manufactures coke locally, but from Japanese coal.

The production of coal in the Philippines was largest in 1909, when 30,336 metric tons were produced. In 1918 the production was about half that for 1909 (15,663 tons). To date the Philippine Islands have produced 147,280 tons of coal. Serious work in mining began in 1890.

The production of iron from the Bulacan districts and its use in the form of plough coulters and fittings have continued steadily. The old native method of smelting is still used, and the difficulty now encountered by the smelters in obtaining a good fuel supply near the mines is a reason for the decreasing production. The curtailment of pig-iron imports has nearly stopped the manufacture of agricultural and household implements in Manila by the Chinese, who still continue to work intermittently by using scrap. With the shortage of scrap and pig-iron, attention was directed to the possibility of producing grey iron from Philippine ores without entailing the use of much capital. Improvement of the native furnaces was naturally suggested as a possible solution.

The Manila Iron and Steel Company was to erect a small blast furnace in Batan and exploit the deposit of magnetite sand found naturally concentrated along Limay and Mariveles beach bordering Manila Bay.

Exploitation of the iron deposits on Calambayanga Island has commenced. The Philippine Mining and Industrial Company, a Japanese concern, has recently bought the property and started intensive exploitation. A shipment of iron ores to Japan was to be made shortly. The National Iron Company has been created by the Government to exploit the iron deposits of Surigao and manufacture iron and steel. The Vamenta Chaves Mining Company has also been organised recently to exploit the newly discovered iron deposits in Bukidnon, Mindanao. The ore is practically pure magnetite, and the deposit is claimed to be very extensive.

The increased prices of manganese ore during the war caused a rush for further search of new deposits of this ore throughout the Archipelago. Ilocos Norte, Pangasinan, and Masbate, all three districts known to contain manganese deposits, have again been prospected and new locations and relocations of manganese claims have been made there. However, the prohibition against exporting war minerals to foreign countries and the excessive freight rates seem to have paralysed the development of the industry. Only 650 tons of ore have been reported as the production from Ilocos Norte during 1918. In 1916 some 3,000 tons were shipped to Japan, but no further shipment was made.

COMMERCIAL MOTOR VEHICLE EXHIBITION IN LONDON.

A GREAT BRITISH INDUSTRY INSUFFICIENTLY REPRESENTED IN THE FAR EAST.

From the point of view of those who aim at strengthening British manufacturing interests in the Far East, the important and successful commercial motor vehicle exhibition just held in London at Olympia has one outstanding feature. It is the great scope and efficiency of the industry in Great Britain compared with the rather meagre extent to which such industry is represented and its interests advocated in the Far East, more particularly in China, Manchuria and Japan. No doubt the busy and, on occasions, crowded spaces of an exhibition do not offer many or very favourable opportunities for discussing what is happening in far distant markets or for considering and materialising projects for their exploitation. On such occasions the attention of manufacturers' representatives seems largely occupied with the immediate requirements of centres more closely to hand. To these causes we would fain attribute the insufficient interest—as it is possible to gauge such interest from investigation at the exhibition—which many manufacturers show in the great potentialities of their Far Eastern markets. It would almost seem that these important London displays, with the expense and time they necessitate, detract for a period manufacturers' attention from overseas trade. Manufacturers would, we feel sure, be amongst the first to deny this, and the large number of visitors from abroad who visit the exhibition and the number of orders received from foreign customers are certainly in favour of their assertion. There is a general opinion, moreover, that these exhibitions are held to strengthen overseas rather than home trade. For other foreign markets this may be so, but the assistance such exhibitions have in assisting British interests in China and Japan is ephemeral, and more direct measures are necessary. Judging from the dimensions of the commercial motor vehicle exhibition, as indicated by the exhibits at Olympia, manufacturers must contemplate securing a large share of foreign trade, for their manufacturing facilities are in excess of anything that can be required in satisfying the home demand. They may be obtaining a fair share of trade from other countries, but this is not the case with Far Eastern territory, and it is to be hoped that a very short interval will elapse before greater enterprise is given this part of the world. Major Goddard, the Commissioner appointed by the British industry to visit various countries, including the Far East, and investigate foreign markets, has now returned to England and is reporting. In many respects his tour is proving of most practical value to manufacturers, and it may be expected that the outlook for British commercial motor vehicles may be improved as a result of his recommendations.

COMMERCIAL INTERESTS IN THE FAR EAST URGED TO CO-OPERATE.

If the end in view is to be obtained success will rest to no little extent on the measures commercial interests in the Far East take in getting into touch with British manufacturers and in securing and efficiently handling the representation of these manufacturers' interests. Inquiries made certainly prove that many valuable agencies for Far Eastern territory are now awaiting negotiation. It is quite the exception to find a firm with direct representation in this part of the world. The co-operation of business interests in the Far East is sought in remedying this condition of affairs as road transport develops. The attitude so many manufacturers have adopted is largely due to a sufficiency of orders in markets nearer home with which they are more familiar. Manufacturers appear to be fully alive to the difficulties of securing business with the Far East, as we see them in China's inadequate roads. They attach, however, insufficient weight to what is being done to surmount those difficulties, to the very many important road construction schemes in hand or under consideration, to the vast importance all modern interests in China attach to better transport facilities, and to the enterprise shown by their American competitors. So far as China is concerned, the vast majority of manufacturers are waiting until the demand develops. If, however, no steps are taken to create or to stimulate the demand, then a handicap will be placed on British trade. The capability of British makers to supply the right kind of vehicle has been proved beyond possibility of doubt by the successful operation of British vehicles in the war zones. The industry is strongly organised in Great Britain, and we understand that the Federation of British Industries is willing to support and co-operate with manufacturers in any measure taken. Thus well equipped, the industry should make a much keener bid than it is doing at present to establish itself in Far Eastern territory.

TREND OF DEVELOPMENT IN COMMERCIAL MOTOR VEHICLES.

The variety of vehicles shown at Olympia, as well as the excellence of workmanship, should assure success in Far Eastern markets if backed by adequate commercial methods. All types of vehicles were well represented, whilst certain new types were on exhibition for the first time at the exhibition, which has not been held since 1913. Electric vehicles were amongst the latter, and this type is proving itself admirably suited for haulage and delivery work in and around towns. A six-wheeled lorry was also a newcomer. This is provided with three axles, and enables the load to be distributed fairly evenly. It will carry a load of 7½ tons and haul an additional 6 tons in a trailer. Its axle weight is said not to exceed that of a 3-ton lorry. Many vehicles were constructed for dual purposes. This was particularly noticeable with vehicles for municipal work. Another instance with which we are more familiar is that of the tractor which can be converted into an 8-ton road roller. In this connection Messrs. Thornycroft exhibited a hydraulic tipping wagon which can be supplied with a 750-gallon watering tank interchangeable with the tipping wagon.

Although improvements in details were many, it was difficult to find developments of importance. The four-cylinder engine with cylinders cast in pairs has become practically standard practice. Increased lightness is obtained without sacrifice of strength by the use of improved or new materials, and the more judicious selection of special material for special duties. The machines are in very many cases turned out in large numbers with the aid of improved machinery. This assists standardisation both in design and appearance, and, of course, makes for efficiency in operation. One of the few outstanding features was apparent in the increased use of rubber tyres. Even on the heaviest vehicles solid rubber tyres are now fitted, whilst pneumatic tyres in place of solids are installed on vehicles of the lighter type. Engine speeds remain at 1,000 to 1,200 r.p.m., but makers guarantee their machines to stand up to greater acceleration for a considerable period without being jeopardised. The use of paraffin as a fuel is not increasing—rather the reverse. Less is heard about the paraffin vaporiser than was the case a few years ago, but provision for the use of paraffin as a fuel is, of course, made as required. Gear boxes with three or four speeds are about equally divided. The sliding type with gate change is almost invariably used. The worm drive for back axles is gaining ground. Side chains enclosed in oil-tight casings are still largely used, and the cast-steel plain spoked wheel is becoming increasingly popular for heavy vehicles.

The exhibition can naturally be divided into two sections—the heavy motor vehicle as distinct from the light delivery van. In the former the increasing attention being given to steam vehicles was noticeable, and further developments are promised in this section. A steam-driven 6-ton wagon was exhibited in which the uniflow engine is installed, a distinct departure so far as British practice is concerned. The advantages of this type of prime mover in economy, flexibility and upkeep will be well known to engineers. Its use is mostly associated with large industrial projects, but its advantages extend down to the smallest sizes. Transmission in the wagon referred to is by direct action from engine to the live axle. A vertical water-tube boiler is supplied, and a superheater coil is fitted in the top of the fire-box.

RUBBER SEED OIL.

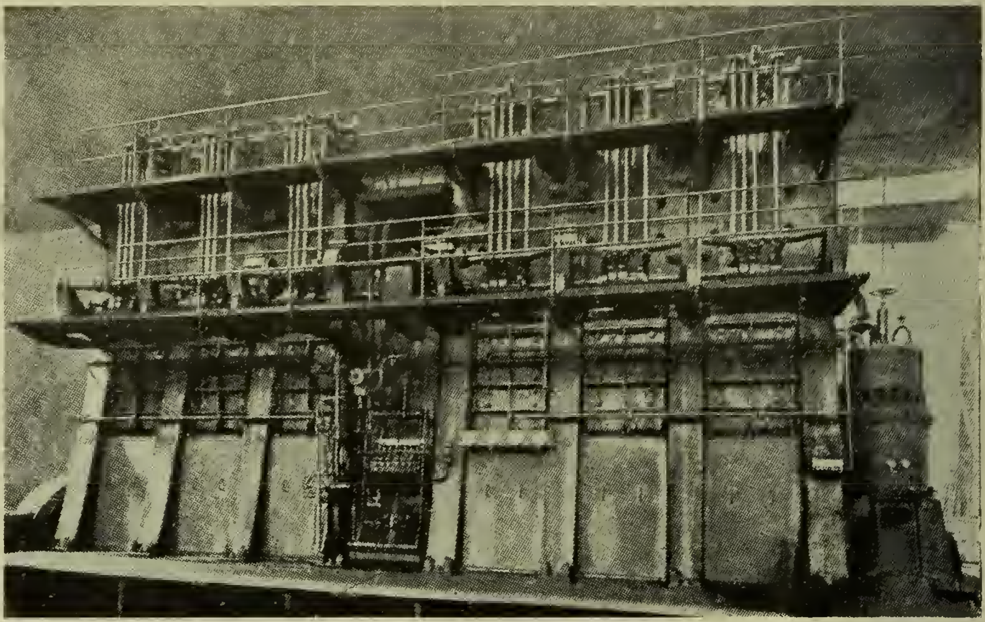
In his report on the Agricultural Department of the Federated Malay States, the Director of Agriculture (Mr. L. Lewton-Brain) states that the experimental hydraulic oil-expression plant of the Department has been lent to the Malayan Oil Mills, Ltd., a local company formed primarily to manufacture rubber seed oil. It has been ascertained that seed on storage deteriorates and produces an oil containing up to about 25 per cent. free fatty acids, and that such oil is not generally suitable as a substitute for linseed oil. Further, this oil is not suitable for many purposes owing to its slower drying power compared with linseed oil, and it is necessary to prepare a " boiled " oil for commercial purposes. Considerable progress has been made in the work of refining the oil, but it is probable that the processes required can only be carried out in a factory under the supervision of a trained chemist. Experiments on the preparation of " boiled " oils have shown that a satisfactory product can be obtained from a raw oil free from fatty acids. A further problem, namely, the prevention of the deterioration of seed on storage, remains to be attacked. Freshly collected seed yields an oil with a very low acid content.

Full reports on the commercial possibilities before rubber seed oil have appeared in this journal from time to time.

DEVELOPMENTS IN MOTOR SHIP-BUILDING.—I.

RELIABILITY AND ECONOMY OF DIESEL MARINE ENGINES.

For some time past there have been many indications of great development in the use of marine oil engines for ocean-going motor ships and in the design and manufacture of oil engines of a Diesel type of from 150 h.p. upwards, and of semi-Diesel engines up to 500 h.p. In Great Britain the Admiralty Engineering Laboratory is about to undertake further research and experimental work in connection with the Diesel engine, particularly it is understood as regards the manufacture on commercial lines of the two-cycle double-acting engine, whilst in the United States Congress has authorised financial support for motor shipbuilding. Developments are taking place on the Continent where, however, the position is still handicapped, or was handicapped until quite recently, by inability to obtain materials. In certain instances engines of new types have not yet been delivered, and orders in the hands of leading firms are sufficient for two years ahead. In Great Britain activity has been particularly marked since the Armistice, and manufacturers are able to supplement Continental practice with their own experience. Many improvements in detail, though not in principle, have taken place, particularly in securing increased reliability and greater economy in maintenance and upkeep. As increased manufacturing scope enables the demand to be overtaken, keen competition of an international character is anticipated. If this turns out to be the case, we do not doubt Great Britain's ability more than to maintain her position. It has been remarked that firms with the longest and best record as steam-engine constructors have made the best Diesel engines, and that only such include really large Diesel engines in their standard sizes. British manufacturers' foremost position as steam-engine builders needs no emphasis here, and there is every justification for claiming that they will occupy a similar position as regards the large marine oil engine. The general facts summarised above cannot be too clearly realised in the Far East. In this part of the world shipbuilding has made immense strides during the past few years. But although, as we have stated on previous occasions, the Far East is able to construct its own hulls, it will be a good business policy for builders here to continue to place orders for large marine oil engines and auxiliary machinery in other countries where the problems involved have been so long and so closely studied.



One of the Burmeister & Wain Twin Main Diesel Engines installed in the Motor Ship "Afrika," of the Danish East Asiatic Company, specially designed for Far Eastern trade.

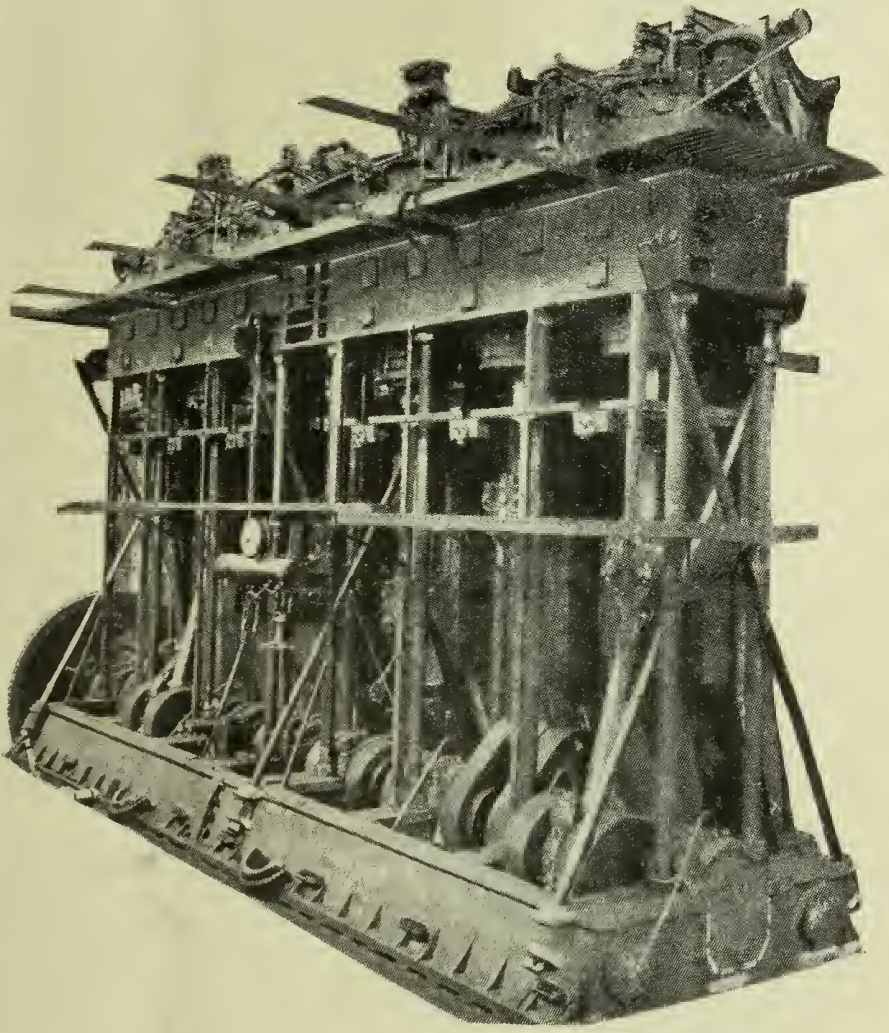
Far-reaching developments are also foreshadowed in the use of the marine oil engine in conjunction with sail shipping, the mechanical power being used when the vessel is becalmed. In this connection it may be pointed out that the tonnage of sail shipping, as disclosed by the report just issued by *Lloyd's Register of Shipping*, shows an increase of from 5,796 tons in 1914-1915 to 66,641 tons in 1919-20. Indeed, many think that in the increasing use of the marine oil engine we are witnessing the beginning of a movement which may before many years have passed lead to a re-building of the merchant fleets of the world.

Referring again to Lloyd's Report, we find that during 1919-20 classes have been assigned to 28 new vessels of 79,805 tons, fitted with such engines as their main propelling power, 20 of these vessels having a collective tonnage of 76,993 tons. There are at present in course of construction under the Society's survey upwards of 150 sets of Diesel engines, and about the same number of sets of oil engines of other than the Diesel type, approximately half of which are building in the United Kingdom. In addition, oil engines are being used in large vessels as emergency sets.

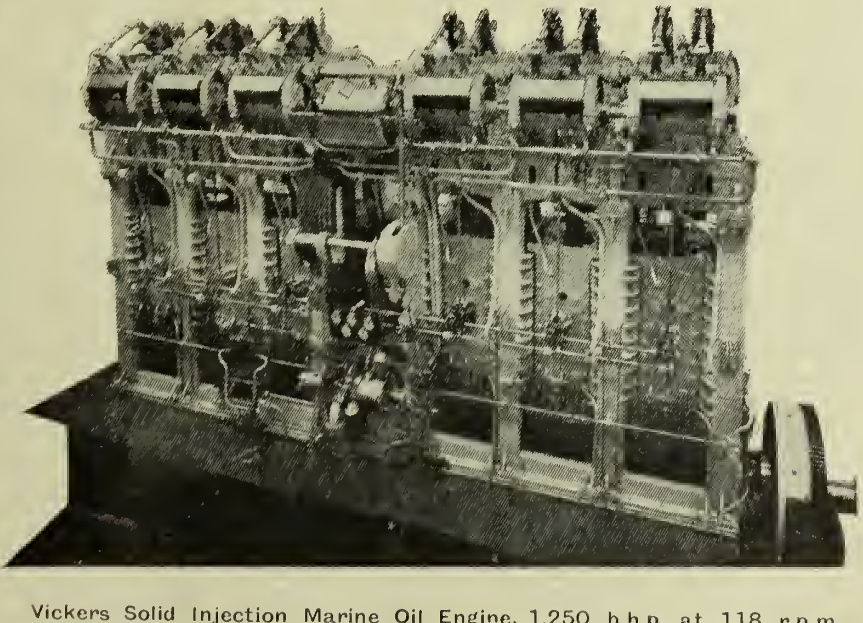
The extent to which the oil engine is being adopted is all the more noteworthy, since the perfect type has not yet been evolved. Considerable modifications are still being made in the design both of the Diesel and other types. Most of the former are of the four-stroke cycle, with oil fuel injected by blast of high-pressure air. But the plan adopted in submarine engines for the injection of fuel without the use of air is, with certain modifications, also being tried successfully. In this way the plant required for air compression is considerably reduced, as compressed air is then needed only for starting and manœuvring, effecting an economy in power. In another type of oil engine the manufacturers are looking in another direction for development. They have changed from a pressure system of fuel injection to one combining oil pressure with an added high-pressure air blast for more effectively spraying the oil.

The often-repeated limitations of the Diesel engine as to size and power output remain with us to-day. Even with our present engineering skill it is not considered practical to construct Diesel engines with cylinders of more than 30 in. diameter with a maximum of 250 h.p. for the four-stroke and 400 h.p. for the two-stroke. Within these limitations, however, substantial progress has been made, and good performance, with a reliability equal to that of the steam engine, is recorded. Moreover, the Diesel engine of to-day by no means represents finality in design. If the experimental work in connection with the double-acting engine proves successful, it should be possible to double the power now possible and to secure a maximum of 12,000 h.p. as against 6,000 h.p., which is considered the present limit. Until this end is achieved large passenger liners may continue to be oil-fired. But this, as many think, extravagant method of power production will, it is believed, ere long be limited to very large and important ships. Already, for smaller craft, oil-firing is not generally considered a commercial proposition, consuming for a given power nearly three times the amount of fuel required in a Diesel engine. Nevertheless, the many advantages of oil fuel over coal firing must be admitted. Pending the attainment of much higher powers from Diesel engine set, the field already open for existing type is very large. Particularly is this the case if smaller vessels are included, using powers up to 500 h.p. where highly-skilled attention is often inadequate, and where particular scope is offered for the semi-Diesel. The field for the Diesel engine is best gauged by considering the requirements of the mercantile marine and the manner in which the Diesel engine is serving this field. The motor-ship *Afrika*, of the Danish East Asiatic Company, offers a good illustration of what is being done. This vessel, one of the largest Diesel-engined vessels afloat, has been specially designed for Far Eastern trade, and is driven by engines on the Burmeister and Wain system. She is 464 ft. long and of 8,597 gross tons. She has a deadweight carrying capacity of about 13,300 tons and an oil fuel capacity of 1,500 tons. This is sufficient for a journey one and one-half times around the world, her daily fuel consumption being 15 tons. The hull is divided into eight compartments. Her propelling machinery consists of two six-cylinder motors of 2,250 i.h.p. The engine-room auxiliary machinery, winches, windlass, steering gear and pumps are electrically driven. There are 20 cargo winches, of which 12 have a lifting capacity of 5 tons. On her trial trip an average speed of 13¼ knots was attained. Another instance is afforded by the *Glenogle*, one of six 14,000-ton motor-ships for the Glen Line, which recently sailed to the East on her maiden voyage. In this vessel the same type of engines is installed. She is 502 ft. in length with a beam of 62 ft. 2 in., and the propelling machinery consists of two 3,200 i.h.p. sets. Fuel consumption appears to work out at 19 tons per day of 24 hours at an average speed of 12¾ knots. At this speed the mean effective pressure in the cylinders is given as 5.9 to 6 atmospheres, and the speed could be worked up approximately to 14 knots. Electrical auxiliary machinery is installed. The *Glenogle* will trade between London. Singapore and Yokohama, oil fuel sufficient for the voyage home and back being taken on at Singapore. The second 14,000-ton motor-ship for the Glen Line will be completed in the course of the next few weeks. A particularly useful class of motor-ship is now being built for the British India Steam Navigation Company. These vessels are designed to carry 2,050 tons of cargo, and accommodation is provided for 20 first-class and 24 second-class passengers, with a certain number of native passenger. They represent a class of vessel for which a large field exists. In the B.I.S.N. Company's ships the propelling machinery comprises a couple of four-cycle Diesel engines, each developing 600 i.h.p., manufactured by the North British Diesel Engine Works, Ltd., of Glasgow. They each have six cylinders, 15 in. diameter and 30 in. stroke, the normal output being developed at 165 r.p.m. Two two-cylinder Diesel sets of the same design will be installed for driving generators supplying electricity for the electrically-driven auxiliary machinery. To the many advantages attaching to the use of the Diesel marine engine, increased evidence is now obtainable as to reliability. Long voyages of up to 35,000 miles are reported without incident, and leading opinion in shipping circles now regards the motor-ship as a necessity of the future.

Shipbuilding and ship-owning circles have a wide choice in marine oil engines manufactured by firms of the highest repute both in Great Britain and on the Continent. Many types of engine combine the technical and manufacturing skill of both territories. One of the best known types of which mention has already been made is that on the Burmeister and Wain system, for which Messrs. Harland and Wolff, of Belfast, are the sole licensees in the British Empire. These engines are of the four-cycle type. Forty-nine vessels of 405,000 tons d.w. have these engines installed, representing 138,500 i.h.p. in sets from 1,500 to 6,600 i.h.p. A good deal of favourable attention is now being given to the new Werkspoor Diesel marine engine. The North Eastern Marine Engineering Company, Ltd., of Wallsend-on-Tyne, are licensees in Great Britain for this type, which is also built by Messrs. Hawthorn, Leslie & Co., Ltd., of Newcastle-upon-Tyne. The engine is well represented on the Continent as well as in Great Britain, and four American firms now control constructional licences in the States. The largest single engine under construction up to a few months ago was of 1,940 to 2,140 i.h.p. at 110 r.p.m. in six cylinders, 26.378 in. diameter The weight complete with flywheel and thrust block is given as 180 tons, and the length as 33 ft. 11½ in without flywheel and thrust



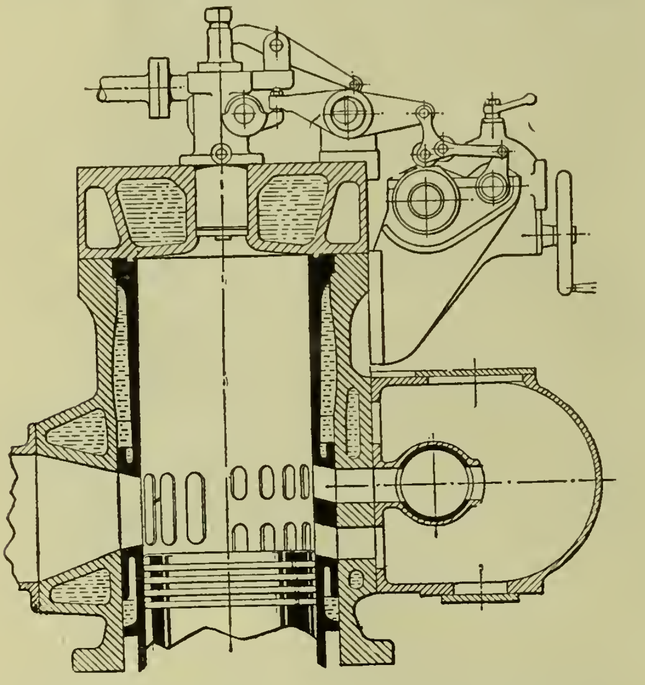
The latest design of Werkspoor 1,450 h.p. Marine Diesel Engine, with oil-tight splash-plates removed to denote its accessibility. The vertical steel column construction, braced diagonally and supported by the cast-iron columns at the back of the engine, has been retained in this design.



Vickers Solid Injection Marine Oil Engine, 1,250 b.h.p. at 118 r.p.m. All types of Messrs. Vickers marine oil engines are fitted for solid injection of fuel. The makers claim that the fuel consumption with solid injection is less than with air injection in similar circumstances. The system of course eliminates the anxiety usually associated with a continuously running high pressure air compressor.

block. The saving in weight and space is thus considerable as compared with geared turbines, boilers and condensers, which may be estimated at 300 tons for the same power, and thus offers additional evidence of the fallacy still existing amongst certain shipowners that Diesel engines are heavier than the latest types of steam machinery. The guaranteed fuel consumption is put at 0.33 lb. per i.h.p. hour, which, however, it is stated exceeds the actual consumption under general ocean-going conditions. This type of engine is of the four-cycle type with open construction. As is general with engines of this size where clearance between piston and cylinder must be considerable, crosshead and guides are fitted. It is claimed for the Werkspoor engine that it was the first built with crosshead construction, a practice now general with slow speed engines of over five or six hundred horse power. The most important development in the new Werkspoor engine is in the reversing mechanism, by which the time taken is changing over from full-ahead to full-astern is from five to ten seconds. A new system of piston cooling has been incorporated, and a force-feed system of lubrication has been fitted to main bearings and crossheads as well as to the cylinders and pistons.

Although the four-cycle Diesel engine was fully developed before the two-cycle type was manufactured, many firms of international repute are closely associated with the two-cycle type. A rapidly increasing number of ships are being fitted with two-cycle Diesel engines, and great development is expected for this system. The advantages claimed are that with a given cylinder volume nearly twice the power can be obtained, hence the engines are smaller and lighter, and offer greater scope as regards power per unit, while less space is occupied for the same power. Amongst the firms identified with the two-cycle engine are Messrs. J. Samuel White & Co., Ltd., of East Cowes, Isle of Wight. The engines manufactured by this firm range in size from 150 b.h.p. to 1,250 b.h.p. in six cylinders, the latter being a crosshead engine of 21 in. bore by 30 in. stroke with a speed of 120 r.p.m. This firm also manufacture oil burning plant, and have constructed oil fuel installations for various Governments and others which total substantially over 1,000,000 horse-power for marine and land purposes. They are, therefore, well placed for catering for the requirements of those using oil fuel either for internal or external combustion. On one or two occasions the "White-Diesel" engines, and also the firm's oil fuel installations, have been described in these pages. The Sulzer engine is another well-known two-stroke type, made in standard sizes from 150 b.h.p. to 6,000 b.h.p. in four- and six-cylinder units. The total output of these engines aggregates 450,000 b.h.p. They are fitted with patent valve-controlled port scavenging, and, it is claimed, have a fuel consumption equal to four-cycle engines under service conditions. Messrs. Armstrong, Whitworth & Co., Ltd., some little time back entered into an agreement with Messrs. Sulzer Bros. to manufacture and sell their engine in Great Britain and the Colonies.



Sulzer Cylinder showing Two-cycle Scavenging System.

A more detailed description of modern Diesel engine design will be published in the next issue of this journal.

THORNYCROFT STEAMER LAUNCHED BY SIAMESE PRINCESS.

Messrs. John I. Thornycroft & Co., Ltd., recently launched at their Woolston Shipyard at Southampton the s.s. *Ville de St. Amarin*, building to the order of Messieurs. Le Groupement Industriel de Charbons et de Transports, Rouen, France. The launching ceremony, including the christening of the ship, was gracefully carried out by H.R.H. Princess Prabhavasiddi, Princess of Kambæng Bejar, Siam, the launching party including, in addition to the Princess, her husband, Prince Purachatra and their daughter, Mr. Stanley (Board of Trade), Mr. and Mrs. Tom Thornycroft, Mr. John Smith (General Manager of the Woolston Works). Mrs. and Miss Kathleen Smith, Mr. C. H. Gilbert (representing the owners), Mr. S. W. Barnaby (Technical Director, Woolston Works), Mrs. and Miss Barnaby, Mrs. Donaldson (wife of Mr. T. Donaldson, Technical Director, Woolston Works), Mr. Litchfield (Local Manager of the Cunard Steamship Co.), Captain G. M. Grandison (Messrs. John I. Thoryncroft & Co., Ltd.), Engr.-Commdr. J. L. Kimber, R.N. (Admiralty Engineer Overseer) and Mrs. Kimber, Col. and Mrs. Greenwood, Mr. S. Mummery (Admiralty Hull Overseer) and Mrs. Mummery, Engr.-Commdr. J. W. Bagulay, R.N., and Mrs. Bagulay.

After the launch the party were entertained at luncheon. In proposing the toast of "Health and Happiness" to the Prince and Princess, who had so graciously honoured them with their presence that day, Mr. John Smith said that, on behalf of Messrs. Thornycroft & Co., he desired to heartily thank their distinguished guests from far-away Siam for honouring the Woolston Works with a visit. They had recently carried out an important contract for the Siamese Government, whereby the Siamese Admiralty had become the possessors of the destroyer *Phra Ruang*, a valuable addition to their gallant Navy, and he was sure that their new destroyer, in the command of Siamese officers trained in the British Navy, would worthily accomplish all that was expected of her. The toast was suitably acknowledged by Prince Purachatra.

As a memento of the occasion the Princess was presented with a handsome piece of silver.

The *Ville de St. Amarin*, which was designed by her builders, and whose keel was laid on October 30, 1919, is of the firm's standard well deck with raised quarter deck type. Her principal dimensions are:—Length (b.p.), 240 ft.; breadth (moulded), 36 ft.; depth (moulded), 18 ft. 6 in.; draught, 16 ft. 9 in.; and her tonnage (d.w.) about 2,000. She is built of mild steel to Lloyd's requirements for a 100 A1-class cargo steamer. The vessel's two cargo holds, one forward and the other aft, contain a combined capacity of 90,000 cub. ft., while coal bunkers for 150 tons are also provided. Water ballast is carried in the cellular double bottom and in fore and aft peak tanks.

The propelling machinery, constructed in Messrs. Thornycroft's engine works, consists of triple-expansion engines, having cylinders 18 in. by 30 in. by 50 in. diameter by 33 in. stroke, developing 900 I.H.P., and giving the ship a speed of 9½ to 10 knots. Steam is generated in two Scotch boilers, each having two furnaces. These boilers are each 10 ft. 6 in. in length, 13 ft. 2 in. in diameter, and provide a working pressure of 180 lbs. per sq. in. The 7½ in. circulating pump is supplied by Messrs. Drysdale; the general service pump and the auxiliary feed pump, each 6½ in. by 4½ in. by 6 in., supplied by Messrs. Carruthers, are of the duplex type, while the Mumford duplex ballast pump is 8 in. by 9 in. by 8 in. The cargo handling equipment consists of four 7 in. by 10 in. steam winches by Messrs. Rogers; two are placed in the forward part of ship and two aft. Four large cargo hatches equipped with eight 3½-ton derricks of pitch pine facilitate the rapid handling of the coal or general cargo which the ship is destined to carry. Accommodation for the captain and officers is provided amidships, while that for the crew is arranged in the forecastle.

It is expected that this ship will be completed and ready for delivery to her owners in about six weeks' time. She will be followed on the same berth by another cargo steamer of 2,000 tons, the first keel plates of which vessel were laid on the afternoon of the launch.

The Institution of Gas Engineers has changed its address to 30, Grosvenor Gardens, London, S.W.1.

Brooks and Doxey (1920), Ltd., the textile machinists of Manchester, are paying a dividend of 15 per cent. on 15s. called up.

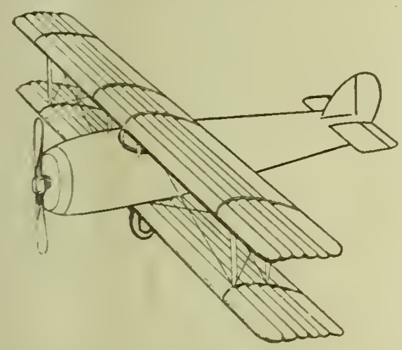
British Aluminium Co., Ltd., have declared an ordinary dividend of 8 per cent. per annum for the half-year.

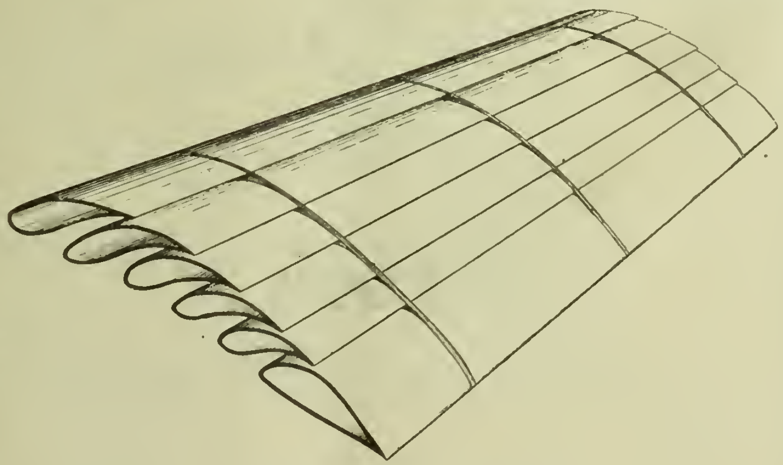
IMPROVED WINGS FOR AEROPLANES.

Earlier in the year intimation was conveyed in these pages that an improved type of aeroplane wing had been designed by Mr. Handley Page. At that time details were not available, but we have now received from the Handley Page Co. the following particulars and illustrations of the development.

The design of aircraft has, from the very commencement, been associated with the problem of safety in rising from and alighting on the ground. Anything which tends to promote slow speed, and therefore safety in landing, is necessarily to the good of aviation. Technically, too, the high speed which an aeroplane can reach in the air is indirectly connected with the landing speed. The special feature of the new Handley Page wing is, that by its use, landing speeds far slower than those obtained up to the present will be possible, or, conversely, greater loads can be carried or higher speeds obtained with the same horse power.

Another special feature of the new wing is that it has very much greater lift for every square foot of its surface compared with an ordinary wing, and this is accomplished by a most simple wing construction, which at first sight would seem to reduce rather than increase the lift of the wing. The construction consists in having slots right through the plane, connecting the lower and the upper surfaces. It would appear that these slots, allowing the air to escape from the under to the upper surface of the wing, took away all the lift. But the reverse is exactly the case. The slots in the wing virtually convert a single wing into a number of wings, and increase the lifting power of the wing two or three times as much as in the ordinary construction.





The New Handley Page Wing.

Supposing, for instance, that a machine to-day lifts a total weight of a ton and a half and has a wing area of 400 sq. ft. With the new construction it will be possible to lift the same weight with a wing area of only 200 to 300 sq. ft. In consequence, owing to their smaller size, the wings can be built much more stoutly without increasing the weight, and so all-metal wings become much more possible commercially.

Beyond this is the further and most important feature. With the high-lifting capacity of these wings it is possible to fly more efficiently at full speed. These new wings at full speed are inclined at larger and more efficient angles than heretofore, so that the lift is obtained with much less horse power to drive the machines through the air. Up to the present it has not been possible to design machines heavily loaded and efficient such as this, because it would have meant the commercially impossible landing speeds of 70 to 80 miles an hour. Now, however, with this new construction, landing speeds smaller even than these now usual have been obtained with all the advantages described above.

It is from a fundamental advance such as this that progress in aircraft will be made. First comes the improvement in basic principle, next the adaptation to engineering design, and lastly operation in service at a decreased cost and with increased reliability to the public. Time must elapse before the public will benefit from these advantages. Minor improvements may be necessary for their full advantage to be gained, but there is no doubt that it is on advances such as these, and we understand that the Handley Page wing is only one of three or four new wing developments, that the future of aircraft development depends.

In viewing to-day the aeroplane fitted with an early type of this slot, it is possible to see the beginning of the practical accomplishment in flying of what laboratory tests have shown can be finally accomplished.

RAILWAYS IN BRITISH MALAYA.

Thanks to the enterprise shown by the Malay States Information Agency in London, a good deal of attention is likely to be given by manufacturing circles in Great Britain to the report for 1919 recently issued by Mr. P. A. Anthony, C.M.G., general manager and chief engineer of the Federated Malay State Railways. The lesson the report conveys of contracts lost through high cost and difficulties of early delivery should be kept prominently before the notice of industrial classes, for such a course is likely to prove efficacious in mitigating those evils to which attention is drawn. The British engineering industry has a sincere friend in Mr. Anthony, and only causes that are potent and clearly defined will induce him to steer business into other than British channels.

Throughout the progress of the war, the railways of Malaya shared with others the difficulty of getting materials for new constructional work and of maintaining the rolling stock to meet the steady expansion of trade which is going on in this progressive region. When peace came, inquiries were made in England for necessary additions to plant and machinery and rolling stock; but increased cost and difficulties of early delivery forced the management to place orders elsewhere, particulars of which are given below. In the introduction to his report, Mr. Anthony says the continued rise in the price of materials and labour will seriously affect the cost of constructing and equipping new railways. Locomotives, which in 1914 were bought for £4,299, now cost £10,475, whilst rails are £16 per ton as compared with £6 15s., and steel bridgework £29 17s. per ton as against £12 7s., and other materials in like proportion, whilst local labour costs have increased by 30 per cent.

The F.M.S. Railways have received twelve Pacific type and two Mallet locomotives built by Messrs. Baldwin, of Philadelphia, U. S. A., during the past year. Of these, eight were added to the stock, and the remaining four were under erection when Mr. Anthony's report was written. Orders, however, were placed in England for ten "I" Class, ten "L" Class and sixteen "P" Class locomotives during the year. The open-line stock of locomotives, including steam rail motors, was 185 on December 31 last, against 180 at the close of 1918. The number of Construction Department Locomotives was 21 against 18 in 1918.

The following new machines were installed during the year at the Central Workshops, Kuala Lumpur, where much more work will be undertaken in future instead of going to other countries:—Machine shop: Four turret lathes, four shaping machines, two boring machines and twelve turning lathes. Carriage shop: One planing and one Tenoning machine. Wagon shop; One wheel lathe. Coppersmith shop: Two bolt-pointing machines.

No new bogie passenger vehicles were purchased in England during the year, but the bodies of eighteen mail type coaches were mounted on underframes received from Japan and turned out. Six others were completed, but not turned out during the year. Twenty-four bogie mail type coaches and one postal-sorting van are under construction at the Central Workshops. Two bogie first and second-class carriages, three bogie second-class and one bogie third-class have been fitted with upper bunks.

During the year 150 new covered goods, 50 firewood trucks, 50 timber trucks and 100 low sides were built of timber and added to the stock. The following statement shows the cost of these locally-built trucks as compared with the cost of vehicles, built of steel, quoted for delivery from England in 1919 (including 20 per cent. for freight erection, etc.):—

	Local trucks.	English trucks.
100 low sides	300	452
150 covered goods	330	547
50 fuel trucks	315	524
50 timber trucks	250	420

It will be seen that by building these 350 vehicles at the Central Workshops, Kuala Lumpur, and using materials obtained from Japan and Canada, a saving was effected of, approximately, £66,700, besides which they were actually at work earning revenue during 1919, which would not have been the case if they had been ordered from England.

Three new steamboats were added to the existing fleet—a stern-wheeler purchased from Bangkok and a stern-wheeler and a steel twin-screw tug built by the United Engineers, Ltd., Singapore, the cost of the two latter being £4,057 and £4,025 respectively. Six steel lighters in use at Tumpat, Kelantan, were also built by the United Engineers at a cost of £1,738 each, and ten teak wood lighters are being built at the Tanjong Pagar Dock, Singapore.

During the year under review, stores and materials were purchased to the value of £819,347, being an increase of £571,448 as compared with the 1918 purchases. Last year's total was made up as follows:—

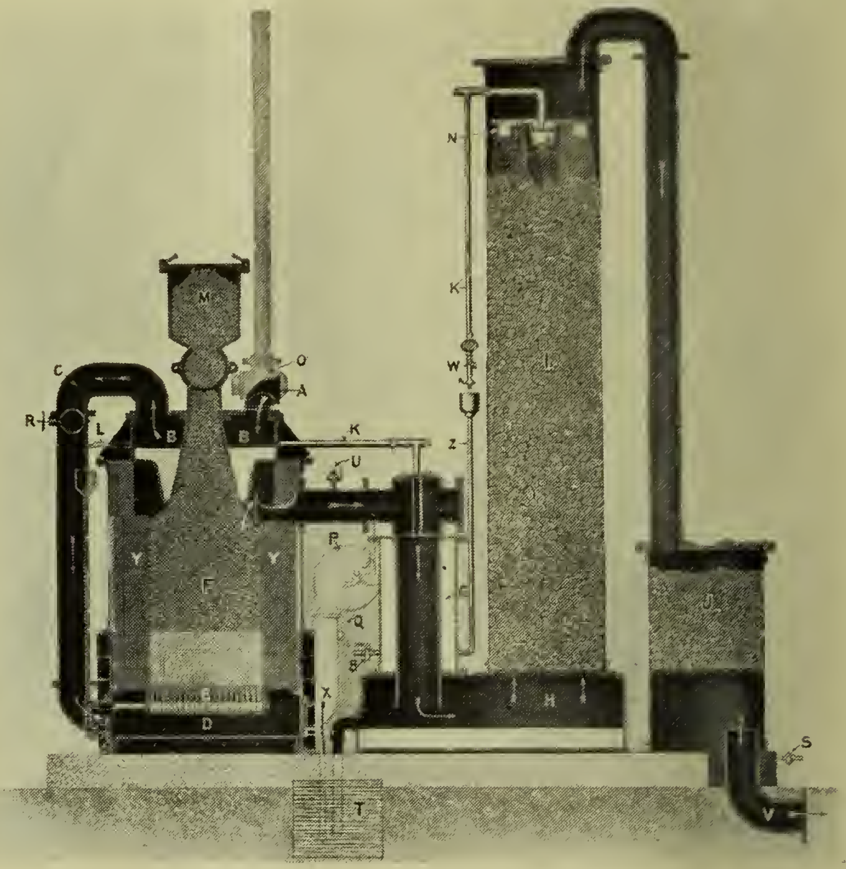
Through the Crown Agents, London ...	£194,539
Local purchases ...	167,329
Purchased in Canada ...	416,611
,, ,, Japan ...	14,461
,, ,, Australia	26,407

The Canadian and Australian figures represent only the materials purchased in these countries which have actually been delivered and taken to account at Kuala Lumpur. Those purchased in Japan have been fully delivered. Included in the Canadian purchases is £5,222 for Singapore Harbour Board, £1,098 for F.M.S. Electric Light Department, and £449 for F.M.S. Posts and Telegraph Department.

There were shipments of stores and materials from the Crown Agents aggregating 2,267 tons, as against 908 tons in 1918; in addition 5,987 tons of stores were received from Canada, 5,815 tons from Australia, and 690 tons from Japan.

Considerable difficulty was again experienced in maintaining supplies of many essential materials, this being due to prevailing industrial and shipping conditions. Prices continued to advance. Supplies from Canada again proved of inestimable value, as did various supplies from Australia.

In the course of 1919, stores and materials for railway construction were purchased to the value of £419,324, of which the amount paid through the Crown Agents in England was £344,900. Twenty-two indents, of an estimated value of £370,016, were dispatched to the Crown Agents.



Grice Suction Gas Producer.

(For detailed description see opposite page.)

MECHANICAL WAVE TRANSMISSION OF POWER THROUGH LIQUIDS.

Hydraulic methods of transmitting power through liquids depend on continuous transmission of pressure, the liquid merely acting as an incompressible flexible connecting rod. Wave transmission, however, depends on the elasticity of the medium through which the energy is transmitted. Energy is transmitted by means of impressed periodic variations of pressure producing longitudinal vibrations. In the application of transmission of energy by wave power, a uniformly rotating crank causes a piston to reciprocate in a pipe which is full of liquid, preferably water, which possesses elasticity, although its degree of compressibility is very small compared to other materials. At each stroke of the piston a zone of high pressure is formed in the pipe, and these high pressure zones travel along the pipe away from the piston. Between every pair of high pressure zones is a zone of low pressure. As the station of the crank is uniform the distance between the successive points of maximum pressure will be equal. If a second crank and piston be placed at the other end of the pipe, rotating at the same angular velocity and in the same phase as the first-mentioned or generating crank, it is evident that the second piston will be able to take up the whole energy produced by the first.

It will be seen, further, that the piston will be able to take up and utilise the whole of the energy of the waves travelling to it if placed at any point of the pipe, provided its time period of reciprocation is the same as that of the generating piston, and provided that the phase of its movement is such as would produce a continuation beyond it of the impinging waves; that is to say, provided the piston movement is in phase with the movement of the layer of liquid in contact with it.

In the transmission of power by wave motion, the maximum pressure in the pipe will at no point exceed the maximum pressure in the neighbourhood of the working piston.

If more energy is put in by the generating piston than is taken up at the other end assuming no frictional losses, it is obvious that reflected waves must be formed as the direct waves fall on the motor piston. The result of this will be that the surplus energy will remain in the liquid and the continuation of the rotation will continually pour in energy, increasing the maximum pressure indefinitely till ultimately, as in the case of the closed pipe, the pipe will burst.

Suppose that, in the case of a closed pipe having a length of several wave lengths, a vessel or reservoir completely filled with liquid, of considerable volume in proportion to the stroke volume of the generating piston and with rigid walls, is placed in communication with the pipe in the neighbourhood of the piston. At each in-stroke of the piston a flow will take place through the entrance to the vessel, and the liquid in this vessel will be compressed, and at each out-stroke of the piston the liquid in the vessel will again expand: according to the volume of the vessel more or less liquid will flow into it and out of it at each revolution of the crank. The capacity of the vessel will thus act as a spring, taking up the energy of the direct and reflected waves when the pressure is high, and giving back this energy when the pressure falls; the mean pressure in the vessel and in the pipe will be the same, so that when the successive reflected waves in the pipe have been produced and have reached a certain amplitude equivalent to this mean pressure, the piston will merely exert energy in compressing the liquid in the vessel on its in-stroke, and the liquid acting as a spring will restore this energy to the piston on its out-stroke. The result of this is that when the reflected waves have been produced, there will be a series of stationary waves in the pipe, and no further increase of energy in the liquid will take place and the pressures in the pipe will never exceed the fixed limit.

By using such a vessel, therefore, the pipe can be completely or partially closed. It is therefore possible to place at the far end or other point of the pipe apparatus for utilising only part of the energy of the wave, and the rotating crank will only require to perform work to the extent of the energy actually utilised.

If a number of motors be connected to the line, every one of them will be able to take some energy and do some useful work. Large diameter, high-pressure, and high frequency are the conditions for best efficiency in a pipe line. A patent flexible pipe is employed when there is no necessity to anchor the pipe line anywhere. It is claimed that there is no vibration in the generator or rotary motors, and that after starting up a wave generator can be left for long periods without attention. The transmission of power by waves through liquids is particularly adaptable to such tools as rock drills, riveters, etc., for use in mining and shipbuilding.

As regards efficiency the economic aspects of compressed air and wave transmission, estimated under average mining conditions, are set out as follows:—

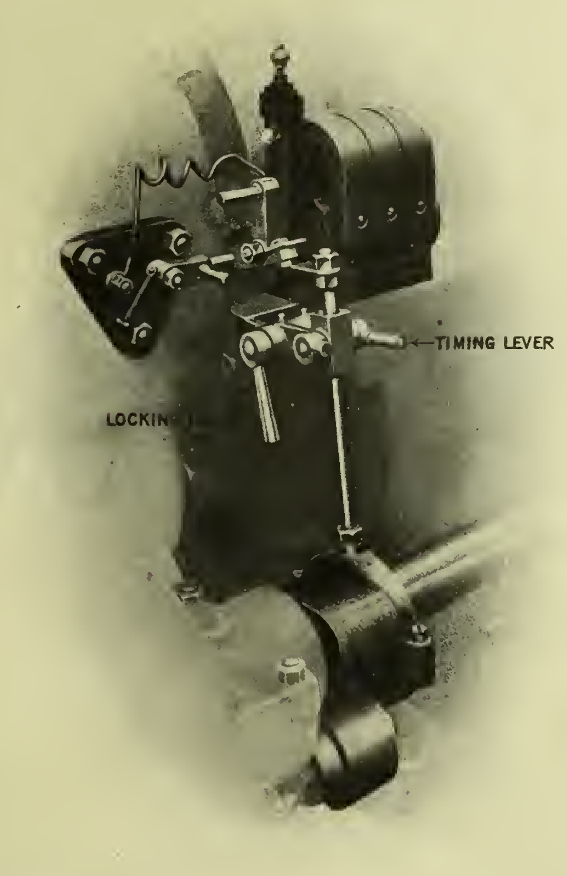
	Compressed air system. Per cent.	Wave power transmission system estimated. Per cent.
Mechanical efficiency overall... ...	10	50
Total power losses in system... ...	90	50
Cost of maintenance of tools per annum, in proportion to original cost of tools	100	33
Capital cost of plant for any given unit including prime mover	100	50

The particulars given above are extracted from material sent us by Messrs. W. H. Dorman & Co., Ltd., of Stafford, who are specialising in wave-power tools, and who are arranging for public tests of their installations.

MODERN SUCTION-GAS PLANT

Amongst industrial circles in Great Britain it is very generally acknowledged that, given proper conditions, the gas engine working in conjunction with a suction-gas producer offers possibilities for the economical production of power which are unobtainable with any other type of prime mover. If this is so in Great Britain, where the choice of means for obtaining power are so varied and competition so keen between different methods, the economy of suction-gas plant is very much more marked in foreign countries, where choice is more limited and where gas can be so frequently produced from what have been considered waste fuels. This point has been so frequently dealt with that it is unnecessary on this occasion to discuss it at length, the object of this short article being rather to describe a type of plant, the correctness of design and accuracy of workmanship of which allow the maximum benefits to be obtained from suction-gas.

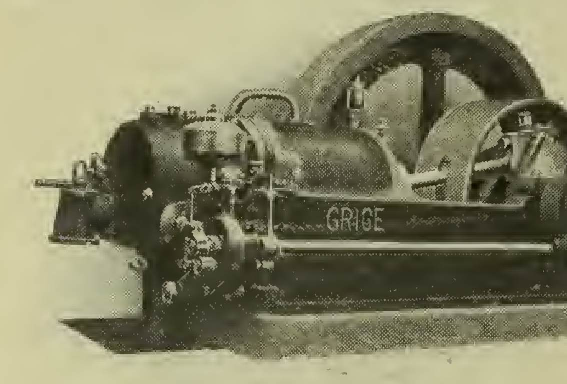
Patent Throttle Governor for Grice Engines, adjusting quality and quantity of mixture to the load.



Magneto Ignition as fitted to Grice Engines. The timing of the spark can be set at will, and no working strain is carried by timing attachment.

The plant selected is manufactured by the Anderson-Grice Co., Ltd., of Carnoustie, Scotland, to whom we are indebted for the particulars and illustrations now given. The Grice gas engine works on the well-known Otto, or four-stroke, principle, and is made in sizes from 10 to 180 b.h.p. on town gas and from 7½ to 150 b.h.p. on producer gas. Experience has shown that for practical purposes it is better to limit the output from one cylinder of this type of engine to 110 max. b.h.p., but with the use of the twin cylinder arrangement loads up to 220 max. b.h.p. can be dealt with. The double cylinder arrangement is exceptionally suitable for electric dynamo driving, or industrial purposes where very steady movement is required, the arrangement being better in mechanical balance than the single-cylinder design. Moreover, if required, it is possible to disconnect one side of the engine when only light loads are required for a considerable period, this effecting an economy in fuel and the lubricating oil consumption.

Four standard types are manufactured, allowing the purchaser to instal an engine specially suited to his requirements The electric type, direct coupled, is fitted with extra-heavy flywheel and outer bearing. The crankshaft is extended beyong the outer bearing to take the driving half of the dynamo coupling, preferably of the flexible type. This type can also be supplied for belt drive. In the industrial type, a heavy flywheel belt pulley and outer bearing are fitted suitable for rapidly varying loads, where a fairly even drive is required. The ordinary type has standard flywheel, belt pulley and outer bearing for moderately steady drive, where close speed regulation is not required. The illustrations on the next page give a good idea of the simplicity and strength of the design, which very largely indeed embraces the points to be looked for when purchasing a gas engine. There is, for instance, no cylinder overhang, the whole of the main working parts being within the bed; the engine is solidly supported throughout its entire length, eliminating tendency to spring under heavy load. The cylinder housing, water jacket and bed form one casting. Every part of the engine is readily accessible, and in the case of the valve chamber only two nuts require removing to get at the valve for cleaning or grinding. The throttle governor installed operates by adjusting the quality and quantity of the mixture to the load by a simple arrangement controlling the travel of the gas valve which puts no work on the governor itself. The Grice governor does not operate, but controls the travel of the gas valve and allows of ample variation of speed by a simple adjustment which can be effected while running. The flywheel is proportioned to suit the particular class of duty for which the engine is intended, and the cyclic variation allowed does not exceed 4 per cent. for the ordinary type of engine, 2½ per cent for the industrial, and 1¼ per cent. for the electric type. Magneto ignition is fitted to all engines, and is of the low-tension make-and-break type. Crank shaft and side shaft bearings are ring lubricated. The crank pin is fed with oil through the crank shaft from a collecting ring on the side of the crank web, which receives the lubricant from a sight-feed lubricator. The larger engines are fitted with mechanical sight-feed lubricators to serve cylinder and piston, and a large sight feed lubricator is furnished with the smaller types supplying oil to cylinder and piston pin simultaneously. Particular attention is given to efficient cooling. The larger sizes are fitted with a rotary circulating pump. For the smaller sizes, from 26 to 96 b.h.p., a hand pump self-starter is fitted, with which a petrol cup can be used as an auxiliary for obtaining a powerful initial explosion. For sizes above 96 b.h.p. compressed air starting equipment is provided.



63 b.h.p. Grice Gas Engine.

A sectional as well as lettered illustration is given on the page facing this article of the Grice suction-gas producer, which works equally well with fuel such as wood charcoal, coke or anthracite coal. The square producer allows of being lined with ordinary square firebricks, which are procurable anywhere and can be set by unskilled labour, an important advantage to the foreign user. Beyond stoking, this type of producer requires no special attention. The arrangement for feeding the fire and producing the gas is extremely simple. Referring to the lettered sectional illustration, the engine is connected to the pipe V, and, on the suction stroke, draws in a supply of air at A, which mixes with the steam generated by the heat of the fire acting on the water in the vessel B. The addition of a quantity of steam to the air passing through the hot fire improves the quality of the gas produced by giving off hydrogen and enriching the gas. The steam and air pass through the fire F and combine with the gases from the fuel to form producer gas, holding in suspension dust and foreign matter, etc., which are abstracted by the gas passing over the water in the hydraulic box H, afterwards meeting the descending water in the wet scrubber I, and finally depositing any remaining particles in the dry scrubber J, so delivering clean, pure gas to the engine. When long non-stop runs are required the installation of twin generator producers is advisable, as by this means one furnace can be thoroughly cleaned out whilst the other is in operation without in any way disturbing the quality of the gas supplied. This arrangement has also special advantages when two or more engines are served from one gas producing plant.

MINERALS IN MALAYA.

According to the report of the Chief Secretary, revenue from mining, excluding special war taxes in the Federated Malay States, in 1919 amounted to $10,489,185, as against $13,969,205 in 1918, the par value of the dollar being 2s. 4d. The high figure for 1918, however, was due to the high price of tin during a great portion of that year, and compared with the more normal 1917 figure, the revenue for 1919 shows an increase of $599,990.

Export of tin amounted to 41,367 short tons (2,000 lbs.), showing a decrease of 486 short tons on the 1918 figure. When the year opened there was no local market for tin, and the mining industry was threatened with dislocation. The Government accordingly arranged to purchase the tin ore produced, and continued to do so up to April 25, when the local market was re-established.

Tungsten ores exported totalled 488 short tons, as compared with 398 short tons in 1918, the increase being entirely due to an increase of over 100 per cent. in the amount of scheelite exported, wolfram showing a decrease.

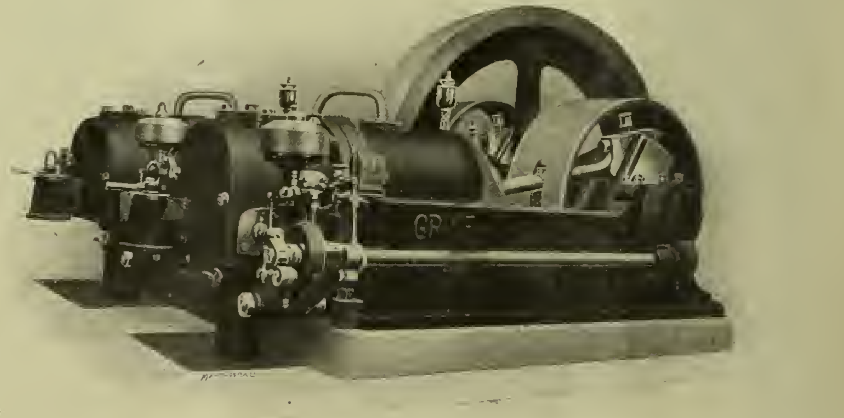
The output of coal from the Malayan collieries amounted to 191,293 long tons, against 168,740 tons in the previous year. The management expect ultimately to attain an annual output of 400,000 tons.

Apart from labour difficulties, general conditions after the first quarter of the year showed a distinct improvement.

VICKERS' AEROPLANE SUCCESS.

A competition was recently held by the Air Ministry for new designs for various classes of aeroplanes, and large prizes were offered. One of these was for an "amphibian"—that is a machine able to land on or start from water or land. In this class Messrs. Vickers have been awarded a first prize of £10,000 for their Viking III.—fitted with a 450 h.p. Napier "Lion" engine.

This machine is the result of experimental work carried out by the aviation department of Messrs. Vickers since the Armistice, and is the first machine to be turned out as a result of that work. Consequently, its cost far exceeds the value of the prize. Being fitted with landing wheels as well as floats, the machine can alight on the water and run along the beach, and the wheels also enable it to surmount sandbanks in shallow water which would capsize an ordinary seaplane.



160 b.h.p. Twin Cylinder Gas Engine.

Experiments carried out on the coast of Japan show that a wave 2 ft. high represents 1 h.p. per linear foot, and at this rate at least 5,000,000 h.p. is being wasted on the Pacific Coast of Japan. The power of the waves was transmitted to a loaded flat board suspended in a pit. The impulse of the waves imparts a pendulum motion to the board and small amounts of power can thus be obtained.

MODERN ENGINEERING PRACTICE.

USES OF THE CEMENT GUN.

The South Wales Institute of Engineers has recently been considering an apparatus known as the Cement Gun, which projects a mixture of cement and sand known as "Gunite" on to surfaces for their preservation. This appliance was referred to some time back in these pages, and has been used to some extent in America. The results obtained are satisfactory, and the surfaces treated have greatly benefited. The cement mixture is fed into the machine in a dry state and blown through the machine, the motive power being compressed air at from 35 to 45 lbs. per square inch. When the dry mixture reaches the nozzle, it is met by a fine spray of water, which, being at a slightly higher pressure than the mixture (say 55 to 65 lbs.), effectively mixes with the dry material. When the material is applied to the surface to be coated, there is a considerable pounding action, which makes for greater mixture and a better quality cement than is possible when the material is applied by hand. The apparatus has been used to some extent in coal mines in cementing underground surfaces, which are first stripped of their rough loose material. The average rate at which cement has been applied has been 814 square feet per hour, four men being employed at the machine, whilst a similar number were engaged during the day screening the sand and cement, mixing them and filling the mixture into the trams. The roof has been coated to an average depth of half-an-inch and the sides one inch. The apparatus, however, is applicable to a wide range of requirements where there is a fairly large area to be covered. For certain purposes in iron and steel works it is valuable, and for such work as lining tunnels, facing reservoirs, coating acid tanks, lining and covering chimney stacks, repairing sea walls, etc. It is also of use in housing construction where steel framing is employed, and generally in reinforced concrete construction. The proportions of the mixture can be varied to suit special requirements varying from a three-to-one to a five-to-one sand-cement mixture.

STORAGE OF BITUMINOUS COAL.

In view of the rapid development of coal mining foreshadowed in the Far East, questions relating to coal storage are increasing in importance. The conclusions to be drawn under this head from the investigations conducted by the University of Illinois Engineering Experimental Station show that the place of storage should be dry and well drained. A hard clay bottom thoroughly drained is desirable if concrete is too expensive. Adequate space should be provided, so that the coal can be moved if heating occurs. Coal is usually stored when the demand is low, say, between May and September, or during the hottest months of the year, and coal stored at a high temperature retains its heat and is much more liable to spontaneous combustion than coal stored at a low temperature. Spontaneous combustion of coal is due to the oxidation of fine coal, and the elimination from the pile of dust and fine coal is recommended. It is advisable to select low sulphur coals for storage. Coal should either be piled so that air may circulate through it and carry off heat generated, or else so closely packed that air cannot enter the pile. Coal should be spread in horizontal layers and the stratification of fine and lump coal avoided. A number of small piles is better than one large pile. Repeated wetting and drying of coal increases tendency to spontaneous combustion. Only in case of necessity should water be used to cool the pile. Coal that has once heated should preferably be used at once. Coal in storage should be inspected regularly, and if the temperature reaches 140 degrees, the pile should be very carefully watched. If the temperature rises to 150 or 160 degrees, the coal should be removed as promptly as possible, and before it actually smokes, which may begin at 180 degrees. Many appliances are available for taking coal pile temperatures, including thermometers, thermostats, recording thermometers, the Zeleny thermometer, pyrometers, thermocouples and potentiometers. Another type of apparatus is mentioned in the next paragraph.

MEASURING COAL-STACK TEMPERATURES.

An apparatus known as the "Thornley Coalometer," designed for measuring coal-stack temperatures at depth, was recently described in *Power*. The appliance consists of three tubes extending to various depths and enclosed in a long, pointed steel case. These tubes end in bulbs, and are filled with alcohol. At the upper end of the instrument are three dial temperature indicators, each connected to a tube. The scale on each dial runs from 32 degrees to about 200 degrees Fahr.; it is coloured black up to 120 degrees, but upwards from that temperature the colour is red, indicating excessive heat. Instruments employed at intervals of 50 ft. have proved very effective, and if several coalometers are inserted into a coal pile at varying depths and in different localities, very accurate information can be gathered for the whole of the pile. Such an apparatus is, of course, useful for a variety of purposes, such as observing the temperature of grain in storage tanks or bins.

INCREASED EFFICIENCY OF THE AGRICULTURAL TRACTOR.

Much valuable data have been obtained by the trials of agricultural internal-combustion and steam-engine tractors just held in Lincolnshire. It has been shown that, with the use of the British self-lift ploughs, almost any direct ploughing tractor can be made a one-man outfit. The machines proved on the whole satisfactory in dealing with most difficult soils, even when cutting three 6-in. furrows. The experience gained with light-weight machines showed these to be efficient. This type of tractor put but little pressure on the soil, and does not form the hard pan which has prejudiced the employment of the heavy machine. British manufacturers are now able to produce a powerful and at the same time a light tractor, economical in fuel, and dependable. Simplicity is the keynote to the types of engine installed, whether two or four-cylinder, and skilled labour is not necessary in working the modern tractor. An acre of light land can now be ploughed on about 2½ gallons of paraffin in just over the hour, whilst a very slight cost in fuel and time enable stiff clay to be dealt with.

OIL FUEL REGULATIONS.

The rapidly-increasing use of oil fuel on ships, either in conjunction with internal-combustion engines or on steamers with oil-fired boilers, is necessitating improved methods of oil storage, and more stringent regulations as to the use and selection of oil fuels. Modern practice in these respects now closely follows the suggestions recently issued in London by the Board of Trade Committee. The flash point of the oil used should not be less than 150 degrees Fahr., and with each supply of oil taken on board a written guarantee should be supplied by the vendor, giving particulars which must be entered in the engine-room log. Oil fuel may be carried in double bottoms. Settling tanks should be constructed separately from the hull structure, and should be tested to a pressure of 15 lb. per square inch. Oil pipes should be of steel, and coupling flanges machined and the jointing material impervious to oil. The engineer should preserve half-pint samples of each supply taken on board, and a test should be carried out to see that the oil does not flash below 150 degrees Fahr.

SEEKING NEW SOURCES OF POWER.

The desire for greater economy in power production is to-day the outstanding feature in engineering development. This is causing engineers to give renewed attention to those great and widely dispersed sources of energy, the winds and the sunshine. These exceed the power of simultaneously burnt coal from 5,000 to 70,000 times respectively. The prospects here must certainly be enticing to great coal-producing countries where the supply of fossil fuel is being rapidly used up. Exhaustion is foreshadowed in England in two hundred years, Germany is given a thousand and the United States two thousand years. In dealing with the world's supply of energy, Prof. S. A. Arrherius, at the Franklin Institute, U.S.A., attached importance to the rôle the solar engine is likely to play, particularly in re-establishing and opening up agriculture in great arid districts in tropical countries and industrial works founded on its use may also be looked forward to. All territory in which the sun shines continuously during the greater part of the year may profit by the introduction of the solar engine. The objection to wind as a source of power is its variability and the high installation costs per unit of power continuously deliverable. Speculative as these conclusions may appear, they still have practical value in view of the rapidly increasing demand for coal. Such demand has about doubled every ten years during the last century, and is now some 1,200 millions of metric tons per year. The world's available supplies are estimated to last some fifteen hundred years. Neither oil nor water power is anything like a sufficient substitute. The world's yearly production of mineral oils represents not quite 3 per cent. of the energy contained in the yearly production of coal. Petroleum ought, therefore, to be reserved for the production of light and lubricants. The energy which may economically be taken from waterfalls in accessible parts of the world is about 50 per cent. of the energy of the present output of coal. The well-situated waterfalls are already developed for the greater part, at least, in Europe, and will not sensibly diminish the demand for coal.

MINERALS AND METALS IN JAPAN.

Statistics published in a recent U.S. consular report show that in 1918 Japanese manganese production reached record figures, which have since fallen away materially. The expansion of the shipbuilding industry and other iron and steel manufacturing industries during the war brought about a greatly increased demand for manganese, as is shown by the fact that 62,842 short tons (of 2,000 lbs.) were produced in 1918, a gain of 42,709 short tons over 1913. In 1918 Japan proper consumed 53,118 short tons of manganese, two-thirds of which was used in the manufacture of iron and steel and the remainder for smelting and other purposes. It is believed the consumption in 1919 was not more than a third or a half of the 1918 amount. Japan in 1918 imported ferro-manganese to the amount of 849 short tons, of which Australia furnished 566 short tons and Great Britain 282 short tons. The principal countries to which Japanese ore is exported are the United States, Great Britain, France and China. In 1918 Japan's exports to these countries aggregated 2,615 short tons, and in 1919 they amounted to 3,079 short tons.

THE COPPER SITUATION.

The September issue of this journal gave brief particulars of the combine to be formed by Japanese copper smelters to relieve the depression of the copper market. The association has been organised by Sumitomo, Fujita, and other chief copper producers in this country, who propose to export copper to the extent of 20,000 tons in all—10,000 to the East, and 10,000 tons to Europe. On the other hand, they are going to co-operate with the Nihon Kozam Konwa-kai (Japan Miners' Club), which presented memoranda to the Premier, the Minister of Agriculture and Commerce, and the Finance Minister in June, suggesting an increase of the import duty on copper from 1.20 yen per 100 kin (the present rate) to 7.00 yen per 100 kin, in order to obviate dumping. It is said that the present price of copper is below the cost of production.

While the annual output of copper in Japan is about 110,000 tons, the stocks of the metal at the beginning of July were estimated at 200,000 tons.

The five copper producers—Mitsubishi, Sumitomo, Furukawa, Kuhara, and Fujita—have arranged to borrow 6,000,000 yen from the Bank of Japan on the security of 15,000 tons of copper in their possession.

Four of the copper producers—Sumitomo, Furukawa, Kuhara and Fujita—have formed a union for the purpose of not selling copper below certain stipulated prices. For some reason, Mitsubishi has not joined the union. The output of the four companies represents 85 per cent. of the copper output in Japan, and 80 per cent. of the copper stocks at present are held by them. With the above-mentioned object in view they will reduce output by 35 per cent., fix a reasonable selling price in view of various circumstances, relieve smaller copper producers by buying goods they are forced to sell at a sacrifice, check import, and encourage export, etc. Of course, they are also endeavouring to secure accommodation of funds for the relief of their present distress.

FINANCIAL SUPPORT FOR IRON FOUNDRIES.

The five large iron foundries of Japan—Honkeiko, Kamaishi, Kenjiho, Wanishi, and Toyo Seitetsu—have recently received nine million yen through the Bank of Japan as accommodation to tide over their period of difficulty. The demand in Japan has fallen away to such a degree that output has again been reduced. During last February the five works decided to curtail the aggregate output to 1,000 tons a day. At the beginning of June it was further reduced to 800 tons, and now it has been decreased to 600 tons.

BOOKS.

THE A.B.C. OF STORAGE BATTERY MANAGEMENT.

By Ernest C. McKinnon, A.M.I.E.E. London: The Electrical Press, Ltd., 3s. 6d. net.

We welcome this little volume, because, unlike most of the literature dealing with storage batteries, it aims at helping non-technical users and attendants. Its value is likely to be particularly marked in territory like the Far East, where there is a largely and constantly increasing circle of machinery users who are not technical men. The use of electricity is rapidly increasing in the Far East. At the same time, the field of utility of the storage battery has become greatly enlarged, and if the advantage of electrical

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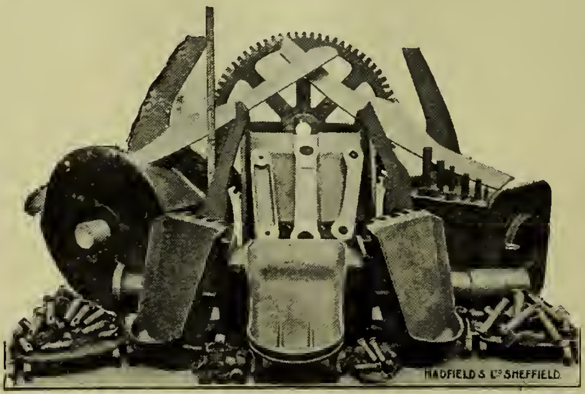
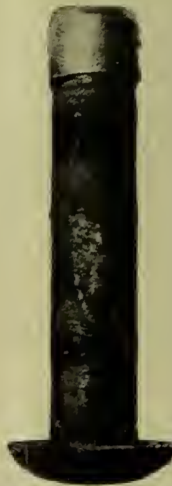
ORDINARY STEEL FORGED PIN AFTER THREE MONTHS' WEAR.





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storage and the management of batteries were better understood there would be few instances of the use of electric power in the Far East in which the battery did not find a place. This great need for familiarity with electrical storage is particularly apparent in industrial circles who, of course, have not the same opportunities as engineers at large generating stations for keeping in touch with the most modern developments of electrical engineering. Little, however, has hitherto been done in the direction we have named, and manufacturers of storage batteries seem strangely backward in exploiting their possibilities in this respect. Mr. McKinnon, the outhor of the book now under review, is Chief Engineer to the Chloride Electric Storage Co., Ltd., one of the best known manufacturers of storage equipment, and in publishing the present work he has done good service both to maker and user. The work is true to its title. It only deals with the management of the storage battery and does not treat of the great economy and convenience of electrical storage. It gives in plain language a condensed, but very complete, review of all the essential points with which anyone undertaking the operation and management of a storage battery requires to become familiar. The book is well illustrated, and covers the whole range of storage battery management, both small and large equipments, whether for central stations or for small industrial and lighting plant. The last chapter gives a glossary of some two hundred definitions of the most common terms employed in battery practice.

A TREATISE ON AIRSCREWS.

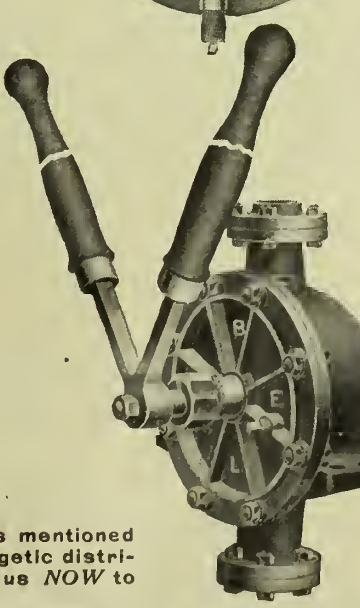
By Whyrill E. Park, A.R.C.Sc., Whitworth Scholar, London: Chapman & Hall, Ltd., 21s. net

This work considers the problems of airscrew propeller design and construction from the point of view of those engaged in the practical design of aircraft. The book treats its subject exhaustively, but does not deal in any detail with the elementary principles of mechanics and aerodynamics. The author is designer for the Lang Propeller Company, and his work follows in general the methods developed by the firm since 1909. Simple design theory has been adopted in preference to elaborate mathematical solutions of theories. This permits of simple methods of calculation of blade dimensions, together with simple modifications for particular problems. It gives sufficiently uniform results for all types of airscrew now in existence, and is altogether more practical. The constructional methods discussed have been developed chiefly as the result of the war demand for quantity production to the neglect of other methods, such as metal construction, now only in its experimental stage, which may ultimately replace the conventional form. The book is divided into two parts. Part I. deals with general theory and design, with chapters on application of theory to particular design, the theoretical investigation of airscrew types, considerations affecting blade dimensions and airscrew performance, stress and structural considerations and external influences affecting airscrew performance, drawing office requirements and miscellaneous problems in design. Part II. deals with construction, general requirements, preparing the airscrew block, shaping and finishing in the white, finishing processes, testing under service conditions and special methods of contribution. Valuable appendices are given of propeller performance and of specifications by the British Engineering Standards Association for aircraft material. The book should become a standard work on the subject of which it treats, and is a valuable addition to the fast growing volume of literature on aircraft design and construction.

PERSONALIA.

In connection with the amalgamation of the businesses of Messrs. W. H. Spencer & Co., boiler manufacturers, of Hitchin, and the Bonecourt Waste Heat Boiler Co., Ltd., of London, Mr. C. W. Catt has been elected chairman of the new company, and Mr. P. St. G. Kirke consulting engineer. Mr. A. L. H. Spencer and Mr. R. A. Sharman, the managing directors, will continue to manage the works at Hitchin.

The death is announced of Sir John McLaren. As a young man he founded, with his brother, Mr. Henry McLaren, the firm of J. & H. McLaren, agricultural and electrical engineers, Midland Engine Works, Hunslet, Leeds. During the war Sir John acted as chairman of the Special Board of Control, and it was in recognition of his work in this connection that he received the K.B.E.



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Mr. Chas. Markham, chairman and managing director of the Parkgate Iron and Steel Co., Ltd., of Rotherham, has resigned his position as managing director, and Messrs. P. W. Fawcett and F. Phillips have been elected joint managing directors. Mr. Fawcett is also a director of Thos. Firth & Sons, Ltd., Sheffield.

The late Mr. W. Chamberlain, chairman of W. and T. Avery, Ltd., and a director of Joseph Lucas, Ltd., Charles Churchill and Co., Ltd., and the Churchill Machine Tool Co., Ltd., left estate of the gross value of £83,861, with net personalty £78,404.

Mr. J. H. Fisher has resigned his seat on the board of William Jessop & Sons, Ltd., the steel manufacturers of Sheffield, and has severed his connection with that company after 34 years' service, latterly as London director.

Sir J. Fortescue Flannery, Bart., M.P., has been elected chairman of W. and T. Avery, Ltd., in succession to Mr. Walter Chamberlain. Mr. A. H. Gibson has been elected vice-chairman of the company.

Mr. R. Traill, a director and one of the managers of the Wallsend Slipway and Engineering Co., Ltd., has been elected a director and engineering manager of the Fairfield Shipbuilding and Engineering Co., Ltd.

We regret to announce the death of Mr. George Tangye, at the age of 85. The deceased gentleman was principally associated with the business side of the famous Birmingham firm of engineers.

The death is announced of Mr. Henry Steel, chairman of the United Steel Co., and of Messrs. Steel, Peech & Tozer, Ltd., of Sheffield, and a director of several other important firms.

Mr. R. F. Cheesman, associated for 25 years with the wire rope manufacturing firm of Latch & Batchelor, Ltd., Birmingham, has been elected a director of the company.

Mr. W. Wolstenholme, general manager of the Bolton steelworks of Henry Bessemer & Co., Ltd., has joined the board of directors.

The death is announced of Mr. Daniel Coyle, M.I.E.E., well known in engineering circles in Australasia and Japan.

Estate of the gross value of £11,013 has been left by the late Mr. R. Barber, steel merchant, Sheffield.

Mr. S. M. Wilford has been elected a special director of W. H. Dorman & Co., Ltd., of Stafford.

TRADE NOTES.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—The directors report that for the four years ended December, 1919, the net profits, after making provision for taxation, depreciation, and the writing down of capital expenditure, amounted to £4,053,605. From this is deducted, says the *Financial Times*, £1,000,000 for further writing down of capital expenditure and £2,465,093 dividends paid for the four years, including the final distribution for 1919, leaving £588,512, which with the balance of £461,387 brought from 1915 gives a sum of £1,049,899 to be carried forward. The reorganisation of the works for peace industries is now complete, and much commercial work has been undertaken.

The accounts of W. H. Dorman & Co., Ltd., of Stafford, disclose, profit, £72,980; brought forward, £145,608; Excess Profits Duty, payable to July 31, 1919, £118,232; 8 per cent. cumulative participating preference dividend, £5,363; ditto for two months ended July 31, 1920, less tax, £3,342; additional dividend on ditto, 1 per cent. per annum, less tax, £1,086; ordinary dividend; 12 per cent. per annum, less tax, for year, £25,355; directors' percentage on profits, £3,386; expenses of public issue in December, £17,874; carry forward, £43,946. The directors have just issued £300,000 8 per cent. participating seven-year notes at £95, together with 50,000 ordinary shares at 22s. per share.

The Vulcan Foundry, Ltd., announce an ordinary dividend, 15 per cent. (3s. per share) for year; the accounts show renewals and depreciation, £60,192; income tax and corporation profits tax, £14,840; capital account in respect of bonus shares issued, £151,251.

The balance sheet of Parsons Marine Steam Turbine Co., Ltd., shows—Profit, £50,282; brought forward, £23,634; less dividend, 25 per cent. per annum, free of tax, less interim dividend, £52,820; carried forward, £21,096.

The accounts of Agricultural & General Engineers, Ltd., show net profits for nine months, £77,096; ordinary dividend, 4.86 per cent. per annum, free of tax; carry forward, £5,348.

The Birmingham Small Arms Co., Ltd., pay a second interim ordinary dividend of 2½ per cent., free of tax.

Bell's United Asbestos Co., Ltd., have declared an interim ordinary dividend of 1s. per share, less tax.

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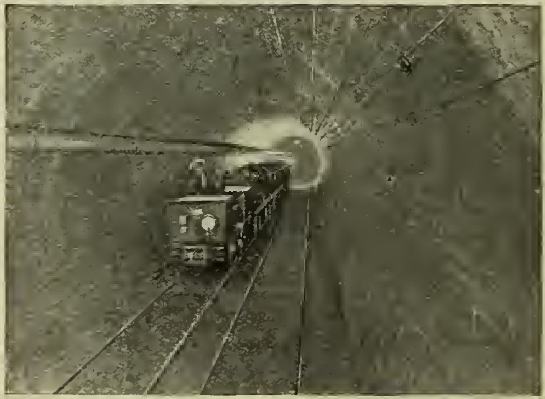

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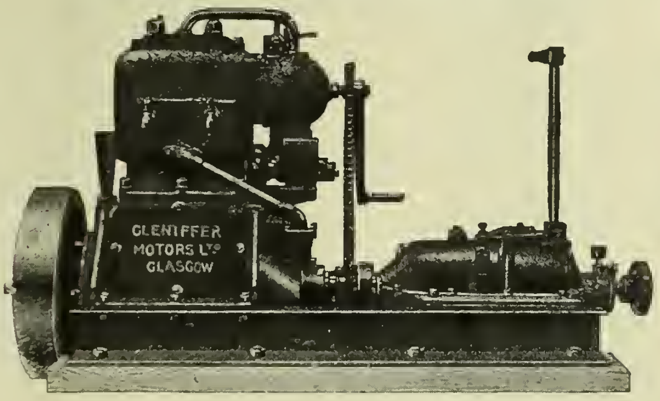

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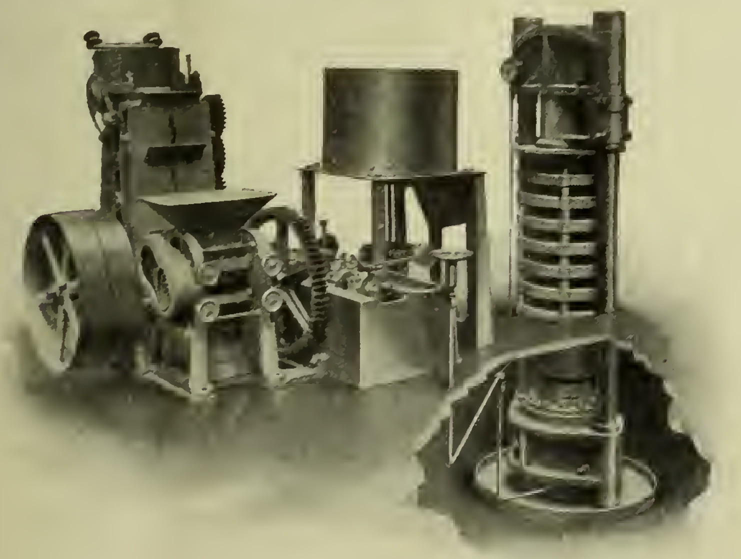

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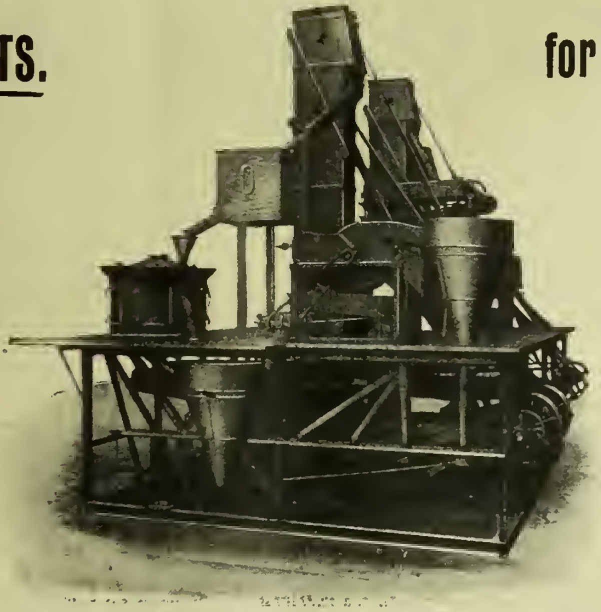

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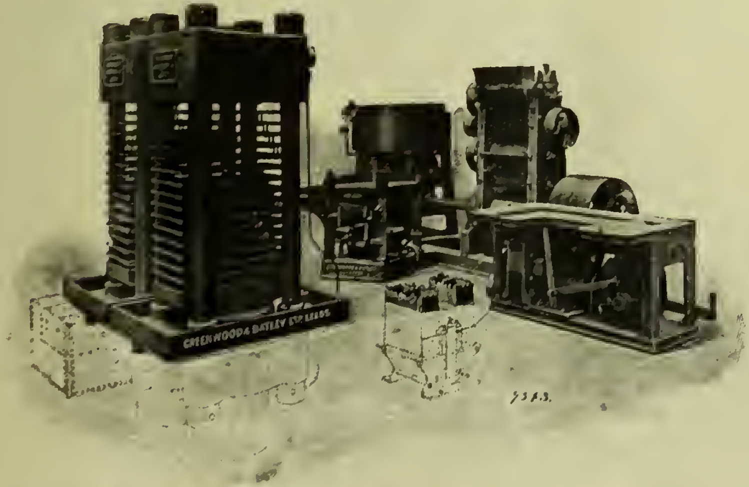

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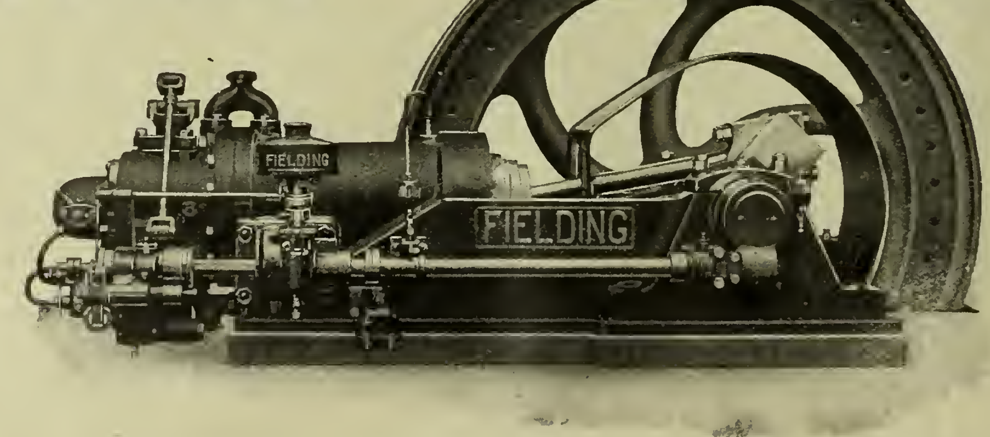

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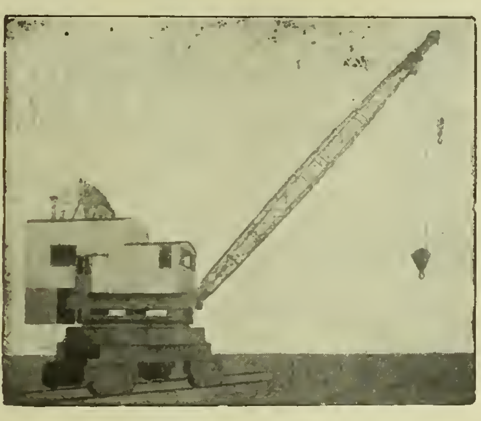

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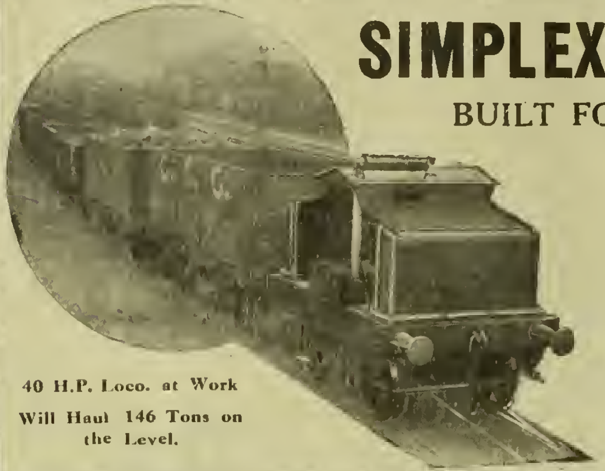

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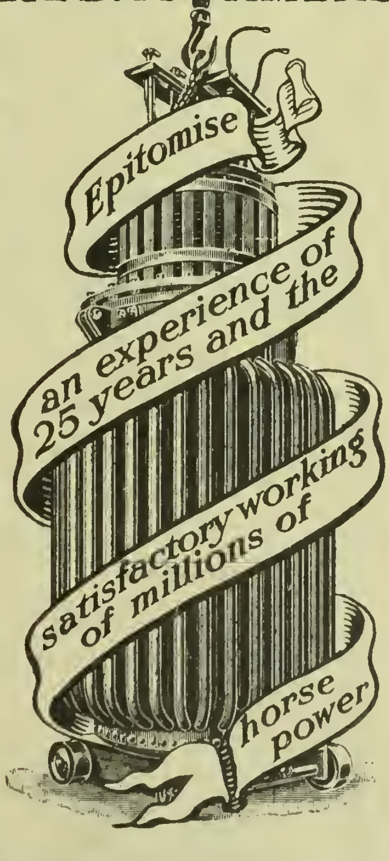

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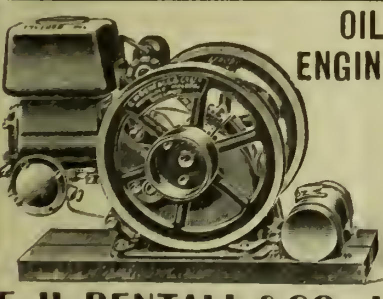

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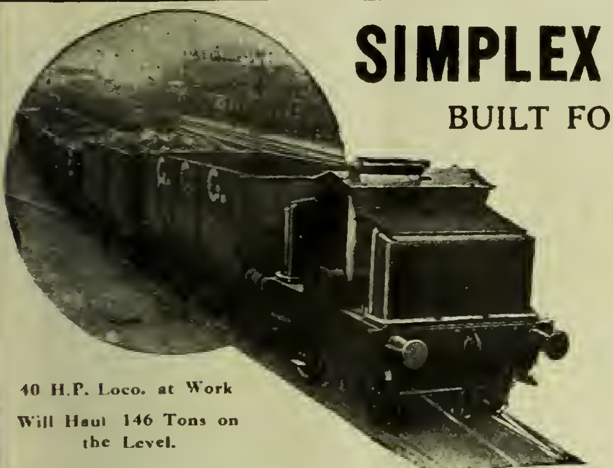

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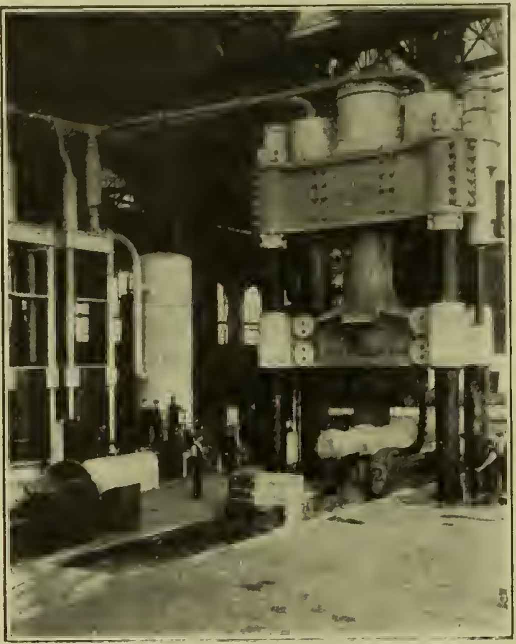

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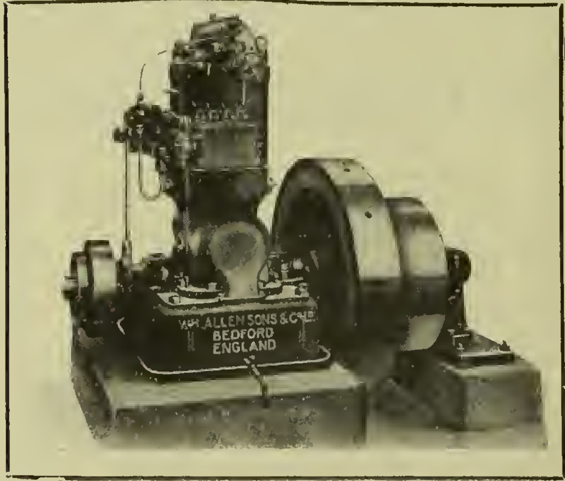

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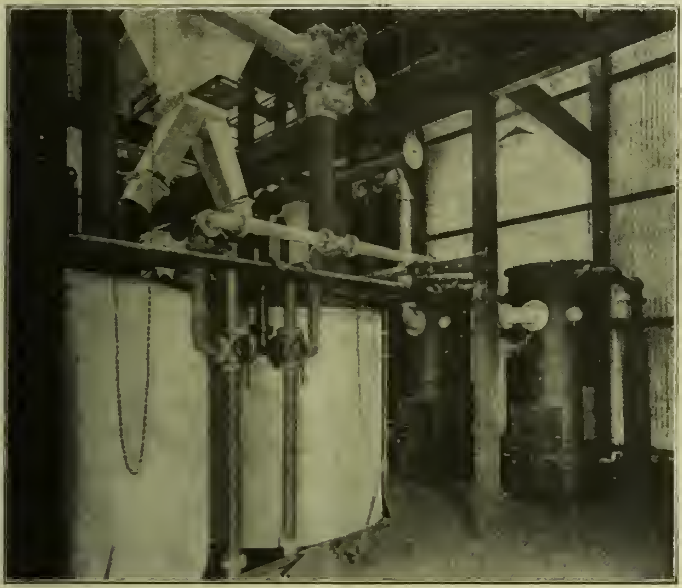

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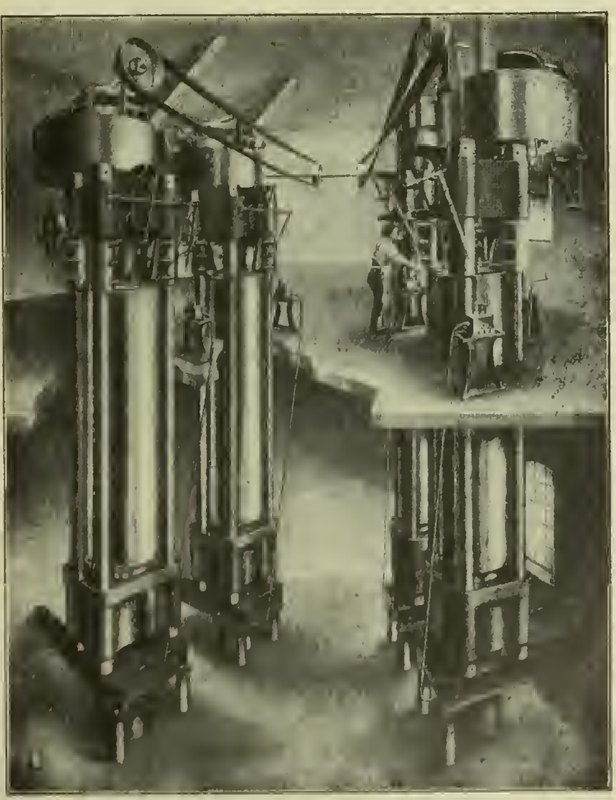

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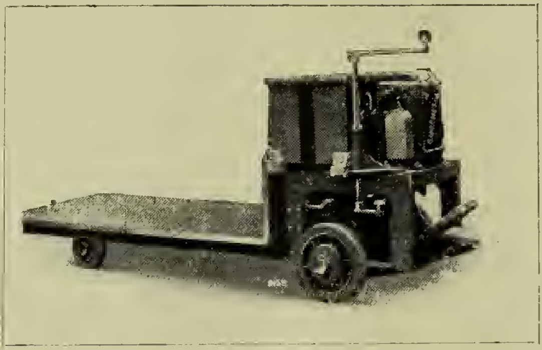

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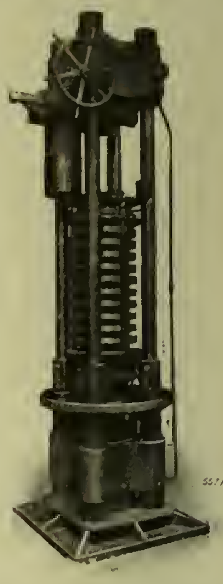

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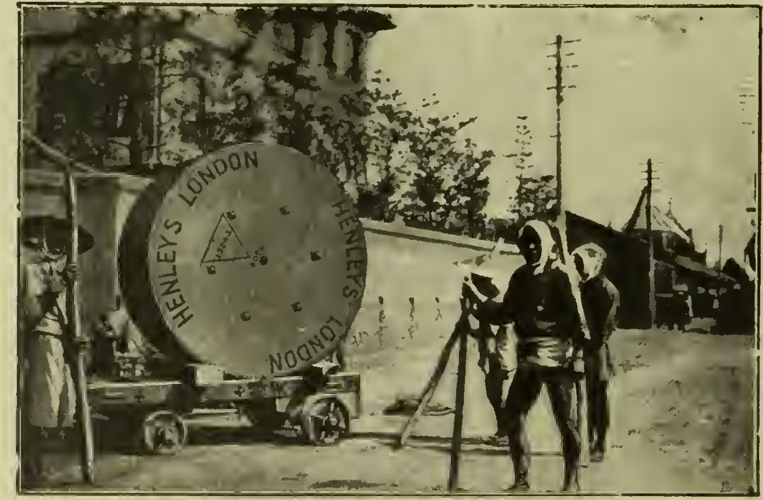

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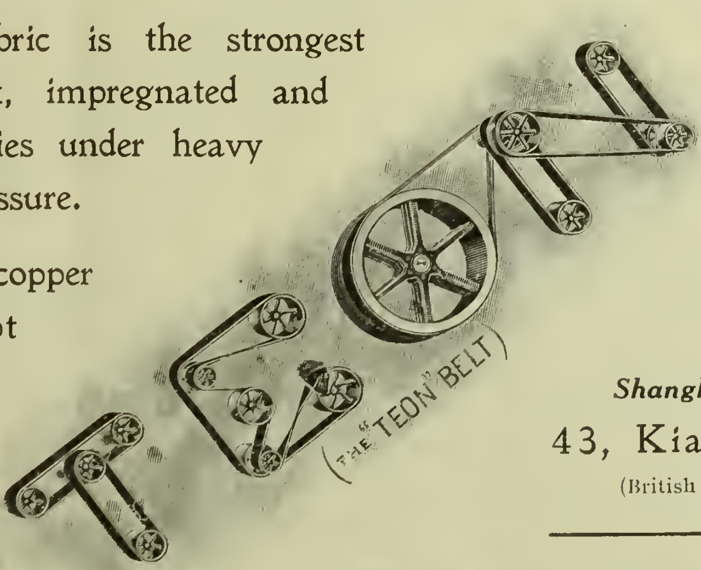

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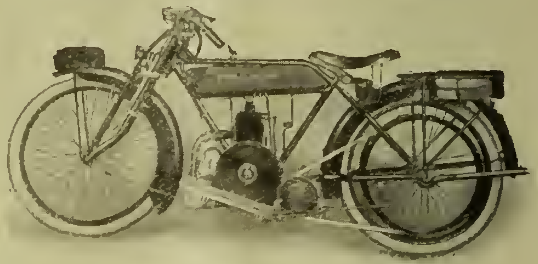

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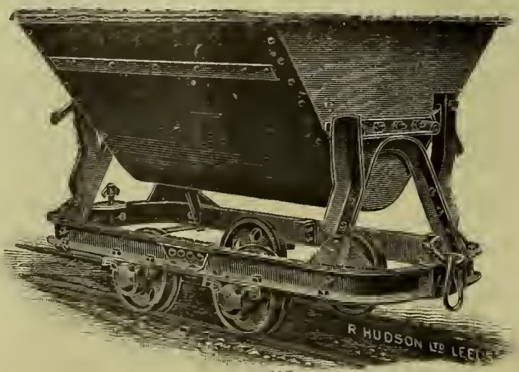

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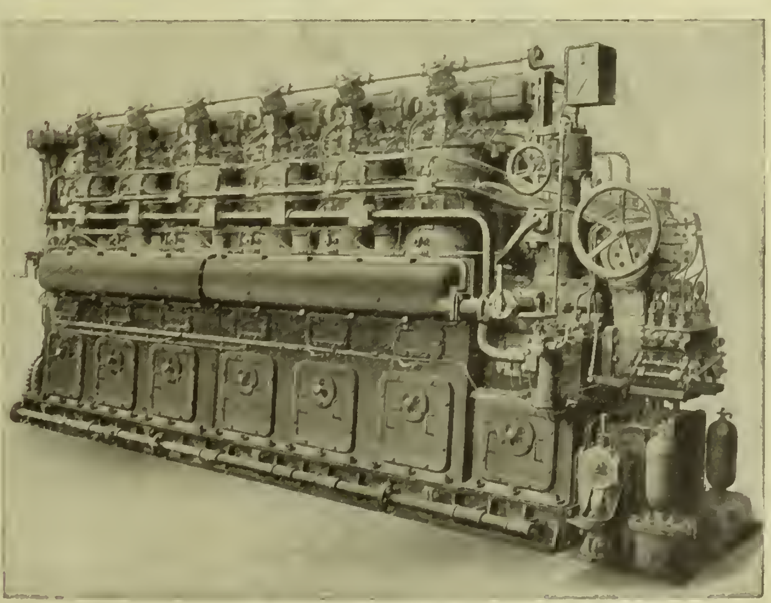

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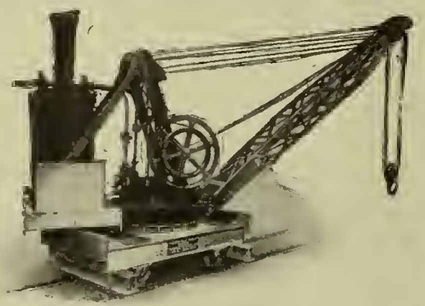

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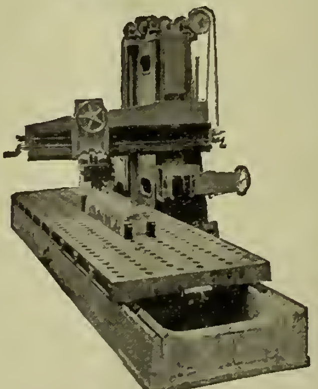

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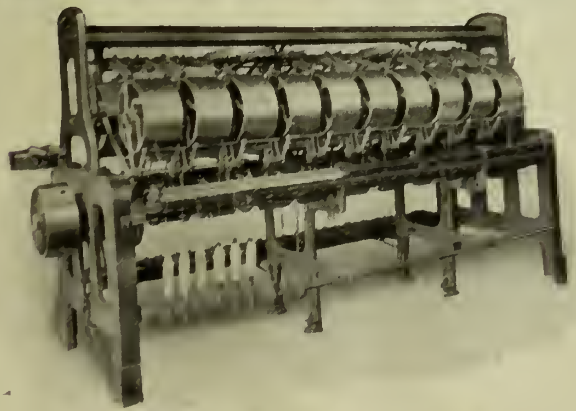

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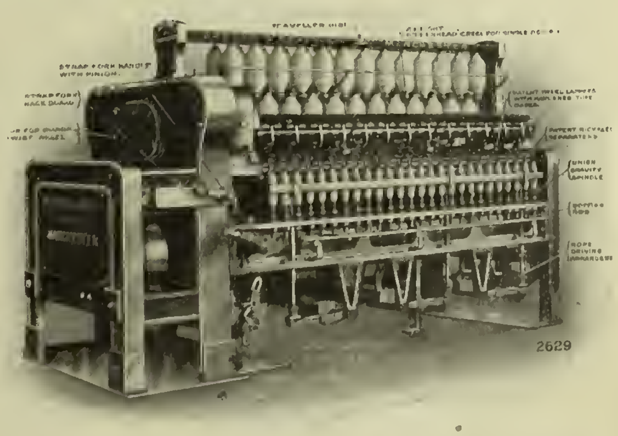

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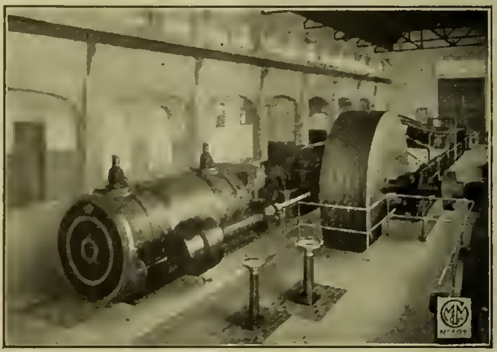

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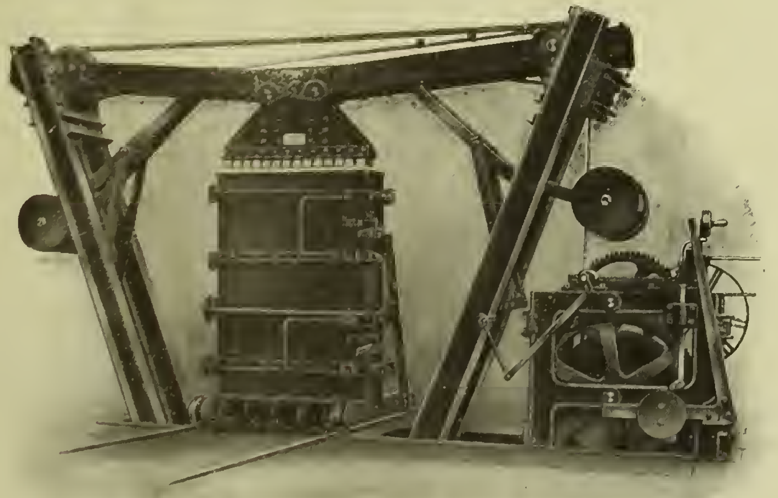

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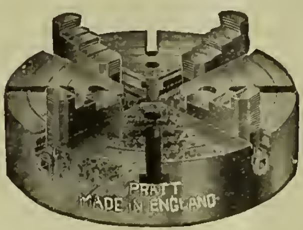

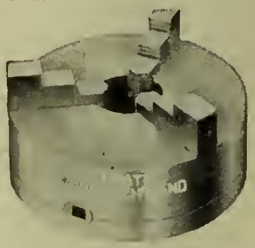

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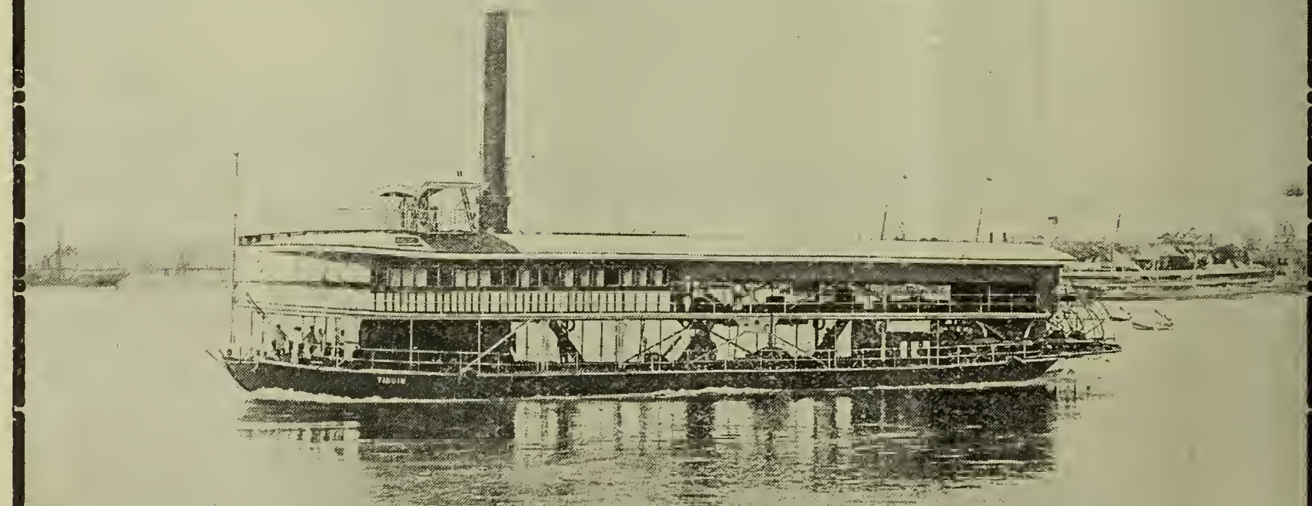

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NOTES AND COMMENTS.

THE ANGLO-CHINESE CHARTER.

Elsewhere in this issue particulars are given of the steps already taken, or contemplated, with a view to the prompt exploitation of the Anglo-Chinese Charter. These steps are being taken under the auspices of the Federation of British Industries, and the policy it is adopting it doubtless deems advisable. Nevertheless, because of the measures the Federation is inaugurating, hopes, it is alleged, are being entertained in certain quarters that the benefits expected from the Charter are likely to be realised somewhat speedily, and that at length a short, direct, and safe road has been opened up for trade with the interior. It will not be well to encourage such anticipations unduly. To such an institution as the Federation the possibilities presented by the Charter, must appear particularly attractive, and if their fulfilment rested altogether with the Federation all would be well—so far, at least, as members of the Federation are concerned. The warning given by Sir John Jordan that the proposal is to some extent in the nature of an experiment must not be lost sight of. Neither must we forget that the reason for taking the measures proposed is to assure authorities at Peking that the Charter has been seriously taken up in London. Those who are finding the capital for promoting the scheme may find their outlay a sound investment, and they are wise in putting up the capital. But what has, so far, been done is merely preliminary, and it will not be well to force progress unduly on this side, and thus lose sympathy and co-operation with native partners to the enterprise in China.

IMPROVING CONDITIONS FOR ANGLO-ORIENTAL TRADE.

It is matter for congratulation that many indications are to hand pointing to more rapid and more certain production in Great Britain's leading industries, particularly in engineering. If the betterment that is indicated can be achieved, one of the greatest handicaps to British trade abroad will have been removed. Improvement in the coal output forms one of the indications alluded to. Since the resumption of work in the mines, after the recent strike, output has steadily gone up. There is now a sufficient supply for industrial purposes, and a considerable surplus for export. The fact that labour is settling down is another indication. The influence of unemployment, the break in prices of so many materials and commodities, the acceptance of lower wages by certain groups of industrial workers in the United States, coupled with the clearer realisation of the need for increasing trade, are all tendencies which facilitate the stabilising of labour. They will greatly strengthen manufacturers' hands in hastening and in guaranteeing delivery. Supplies of raw material required by industry are in several instances in excess of requirements, and are to be obtained at lower prices than the original cost of stocks actually in hand. This is an occasion on which many manufacturers and traders have taken a bold policy, and one which we believe will be successful, inasmuch as they have reduced prices of stocks they hold to a level of current market quotations. The position to-day in industry is one where the facts must be faced with courage, and, in adopting the policy referred to, another handicap to trade abroad—that of high prices—is at least mitigated. The position is one where depression is tempered with hopefulness, and with a disposition to sacrifice, with a view to placing industry on a sounder foundation. This is a mood which should encourage foreign trade, for it distinctly favours buyers abroad. There is a very old Stock Exchange maxim as to the advisability of buying on a falling market, and great possibilities for benefiting by this commonsense policy are now offered the Far East in trading with Great Britain.

THE CASE FOR COLLOIDAL FUEL.

A good deal of attention is now being given to colloidal fuels, and the results being obtained, both in experimental tests and in actual practice, are extremely satisfactory. The solid component of colloidal fuel may be coal, coke, charcoal, hard pitch, or any grindable carboniferous substance. Special economies are therefore likely to attach to the fuel, and its use is rendered not only possible but advisable under widely varied conditions. For commercial purposes colloidal fuel contains 25 to 40 per cent. of pulverised coal, which is held in stable suspension in oil, so that the product can be handled and fired with the usual oil burner apparatus. By means of a suitable stabilising agent a suspension is formed which insures a practical mass uniformity, or a constancy of fuel quality. It may be said that up to about 45 per cent. of coal may be suspended in a liquid product. A large variety of oils may be employed as liquid agents, and fuels available in different parts of the world may be used. A thinning oil, or cut back, may be added to secure greater fluidity. Colloidal fuel has been made successfully from crude oil and wax tailings, thinned with pressure-still oil or tar. Colloidal fuels present no objectionable characteristics when compared with ordinary fuel oil—indeed, they often show substantial advantages over the latter. They are not affected by sea water, and are slow to deteriorate by storage. High temperatures show little change in their physical state, and the fuels are practically non-volatile and show no tendency towards spontaneous combustion. The fire hazard in use or in storage is moderate—less than that of ordinary fuel oil, and such fuels are often volumetrically better in heat than straight oil. Undoubtedly, a very strong case indeed is made out for colloidal fuel.

DEVELOPMENTS IN ELECTRICAL ENGINEERING.

The addresses delivered during the last few weeks at the various provincial centres of the Institution of Electrical Engineers have distinctly an international interest. They may be read with advantage wherever the production and use of electricity constitute an industry of appreciable dimensions. Particularly are the speeches of interest in the information they offer as to essential features for important schemes and for securing such increased economy and efficiency. The use of cables is urged capable of withstanding higher pressures than has been feasible in the past. The admixture of air in the insulating materials has a detrimental effect. Great improvements have, however, taken place, and it is now claimed that it is possible by new methods so far to eliminate the amount of air enclosed in the insulation that it may be safely ignored. Because of this, moreover, it is also claimed that the dielectric loss in a super-pressure cable can be kept within such limits as not to be a material factor. With cables available for working at higher pressures, the advisability of concentrating generation becomes apparent. In large industrial centres waste heat may be utilised for the generation of electricity, and the energy so provided can be delivered into the transmission mains. Improved efficiency may be expected from the use of larger generating units working under high vacuum, higher steam pressure, and heating the condensate by means of steam abstracted from the turbine. A further source of possible economy may, it is thought, be found by re-heating the steam at different stages in its passage through the turbine. The tendency to-day is gradually to raise the temperature of the steam, as experience has been gained with materials most suitable to withstand higher temperatures. Modern developments favour the increase of pressure, with a corresponding reduction of super-heat, and with a vacuum up to 29 inches. Higher speeds for generating plant are also in favour. There will soon be installed in Great Britain a 12,500-k.w. set with 25 per cent. overload capacity for two hours' running at 3,000 r.p.m.. and it is likely that still larger machines running at this speed will be at work in the future. Each development in one section brings with it fresh problems in other departments to be solved in their turn. Great strides are being made in the design of plant and apparatus in all directions, and the addresses we have referred to clearly indicate that greater developments are ahead of us.

CENTENARY OF CHARLES GRIFFIN & CO., LTD.

There has probably never been a time when the call for technical education was so insistent as at present, and in China and the Far East generally the need is as defined as elsewhere. Special interest will, therefore, attach to the centenary of Messrs. Charles Griffin & Co., Ltd., who, as "makers of modern technology," have worthily played a very important *rôle*. In all parts of the world where engineering practice is followed Messrs. Griffin's publications, we venture to assert, are known and appreciated. Indeed, the fact that a book on a technical subject bears their imprint is taken as a guarantee that its contents are valuable. To celebrate the occasion the firm has issued a handsome centenary volume. This sets out at some length the history of the firm. Chapters are contributed by eminent writers on the progress marked by the firm's publications during the last hundred years. Each section of their business—general literature, science, engineering, naval architecture, and so forth — is treated separately, and the result is a work of uncommon interest. There is also a forceful and outspoken foreword by Lord Moulton. The art of printing is only four centuries old in the Western world. To have had a career extending one quarter of that period, and a career that is still developing, is a great achievement. Glancing through the records given in the Centenary Volume, one is struck by the large number of standard works of the highest value published by the firm; also by the skill in producing the right book at the right moment, which seems to have been its characteristic. These are important qualifications to-day, when a rapid and sustained advance in technology is called for in our industrial life. For the last twenty-five years Mr. Francis James Blight has had the management of the business, and to this gentleman and to the large staff who co-operate with him our congratulations are extended.

FOREIGN COMPETITION IN THE FAR EAST.

The return of active German competition for Far Eastern trade is doubted by few, if any, although many differ as to when such return may be expected, and as to the form it will take. Recent happenings in Germany, however, clearly indicate that foreign trade will be sought by large combines. Her efforts in markets abroad are, therefore, likely to be particularly well thought out and far-reaching. In Germany the tendency towards fusions and community of interests—particularly in the iron and steel industries—is strongly marked, and is even more real than apparent. In certain special markets it is also believed that the Government subsidises export trade. So far as machinery and equipment are concerned, Germany has had little to export since the war, but the selling organisation is ready, and in many markets of the world indications of its endeavours are already apparent. Those who have derided German competition in the future are already revising their estimates, and in doing so do not refrain from giving the country credit for its powers of recuperation. Germany's plans for securing Far-Eastern trade naturally give cause for concern in industrial circles in Great Britain, and because of this conferences, such as that of the recent meeting in Shanghai of the British Chambers of Commerce in China, are immensely valuable as maintaining confidence and sustaining endeavour. Manufacturing circles in Britain welcome and will co-operate with the policy advised in Shanghai of meeting the Chinese half-way in development measures. In meeting competition from other nations much may be achieved from a closer working between commercial interests in this part of the world and manufacturers in Great Britain. To urge such closer working—more necessary than ever in the light of actual and potential competition—is the object of this note. German merchants, we note, invariably keep in close touch with their principals and manufacturers at home.

We have received a copy of the first issue of *The Mining Electrical Engineer*, the monthly official journal of the Association of Mining Electrical Engineers. The object of the new publication is to place freely before those interested the record of the work done by the Association, and, in addition, to collate available useful data and to publish details of all those essential factors in electro-mining engineering which make for the progress of the industry. The journal has therefore a definite field of its own and one of increasing importance. A high standard in technical journalism is reached in the first number. The editor is Mr. E. Dinsdale Phillips, and the offices are at Manchester.

The Parson's Motor Co., Ltd., of Town Quay Works, Southampton, forward us a copy of their new 1920-21 illustrated catalogue of marine and stationary oil engines. As in previous editions the book is divided into two portions, covering marine and industrial sets respectively, but on the present occasion the firm have been able to go a little more fully into the accessories, and particulars for stern gear are fully set out, as well as pumps and similar fittings. The catalogue gives prospective clients full information regarding the constructional features of Messrs. Parsons' manufactures, also dimensions by means of outline drawings, and shipping particulars, with full information for the guidance of overseas buyers. Messrs. Parsons have also reverted to their pre-war practice of giving list prices.

The Committee of the Stock Exchange in London has ordered the following shares to be officially quoted:—Callender's Cable & Construction Co., Ltd.—100,000 ordinary shares of £1 each, fully paid (Nos. 400,000 to 500,000). Vickers, Ltd.—7,653 ordinary shares of £1 each, fully paid (Nos. 12,307,981 to ,2,315,633); and 18,065 5 per cent. cumulative preference shares of £1 each, fully paid (Nos. 6,845,763 to 6,863,827).

GREAT BRITAIN'S FITNESS FOR CHINA TRADE.

Early in July last Mr. H. H. Fox, C.M.G., F.R.G.S., H.M. Commercial Counsellor for China, visited England. From that date until the present time he has been actively engaged in giving expert advice and information to manufacturers and industrial circles generally in Great Britain concerning trade prospects in China and the most efficacious means for their development. Mr. Fox has visited most large manufacturing centres, such as Glasgow, Manchester, Leeds, Sheffield, Birmingham, Coventry, etc., and has also paid personal visits to many large engineering works such as those of Messrs. Vickers, Messrs. Greenwood & Batley, Messrs. Herbert Morris, of Loughborough, Messrs. Mather & Platt, and many others. He has interviewed in the aggregate probably hosts of good people, and given and exchanged opinions with very many of the largest manufacturing engineers in Great Britain. And whilst Mr. Fox has discussed China and China trade, he has also received consciously or subconsciously a very clear impression of the industrial conditions to-day in Britain, of her methods and manufacturing facilities, and of her desire and fitness for China trade. With a view to imparting to us his impressions in these latter respects, Mr. Fox courteously granted this journal an interview.

Mr. Fox is deliberate alike in forming and in expressing an opinion, and that the result of some five months' investigation on industrial conditions in Great Britain should have enabled him to entertain and to express, as he expressed to us, complete confidence in Great Britain's industrial position and development will be most gratifying to all who have British interests at heart in the Far East.

DANGERS OF DELAY IN DELIVERY.

There is, however, one feature in existing conditions which gives Mr. Fox concern. This was alluded to on several occasions, and constituted a sombre undertone to the whole of the interview. It refers to delay in delivery and the necessity for more rapid production. Happily, we are in a position to state that British manufacturers are aware of this handicap to their trade abroad. The importance Mr. Fox attaches to it and the evidence he has been able to offer manufacturers of the drawbacks to trade arising therefrom will, we believe, do much to remedy matters. There exists no real reason why production should not be more rapid. Mr. Fox is thoroughly satisfied with the equipment and methods in engineering works, the development of which during the past few years is matter for comment. The employees have the facility and ability for materially hastening production. Mr. Fox evidenced much of what is being done for their comfort and as an aid to all round efficiency. We believe that the evil of delay in delivery is now in course of being remedied, and also that commercial and industrial interests in China will ere long find Great Britain's handicap in this direction steadily diminishing.

If this should prove to be the case then Mr. Fox entertains no doubt as to the country's ability to meet foreign competition in China in all branches of engineering. Development and co-operative effort he finds are particularly marked in electrical engineering. He is favourably impressed by the fact that several important groups of manufacturers concerned with this branch of engineering have combined resources, both technical and commercial, with a view to catering with the greatest efficiency for China and for foreign trade generally. Gradually but surely these powerful groups have covered the whole domain of electricity. They have aimed at being able to say that there is no conceivable electric contract that they cannot undertake and carry through with products of their own manufacture as far as they come within the realm of the electrical industry. The spirit shown in this important branch of engineering during the past few years has been broadminded, liberal, and thoroughly progressive. Its importance to China as well as to engineering interests in Great Britain is obvious.

Throughout his visit Mr. Fox has noticed a better understanding and realisation of China's great potentialities as a market for machinery and equipment. Also an increased willingness to cater for her special requirements and to adapt products and methods to the needs of the China market. He attributes this in part at least to an actual or foreshadowed falling away of the demand in other markets, this necessitating a wider outlook and increased effort to exploit centres further afield.

POTENCY OF THE MERCHANT FIRM.

Mr. Fox finds that the old-established China merchant firm exerts a potent influence amongst British manufacturing engineers, and he himself has a good deal to say on the merchant's behalf. The manufacturer sees that it is a convenient and safe policy to leave his interests in China in the merchant's hands. This may, of course, rob the manufacturer of initiative in dealing with his export trade. He may not even know to what part of the country his goods are being sent. Nevertheless, the policy of depending on the merchant firm of standing is an easy policy and safe financially, and Mr. Fox admits as much. At the same time he urges manufacturers, either individually or in groups, to supplement this policy by sending their own representatives to China to travel the country on their behalf, working in conjunction with the merchant firm. Mr. Fox is of opinion that the efficient technical and commercial representative in China able to represent manufacturers' interests is a scarce commodity. At the same time there are many well-established merchant firms transacting a large Anglo-China trade but maintaining no engineering department. It is suggested that such might find it a sound business policy to consider the establishment of such departments. Mr. Fox believes that the growth and activity of the engineering industry in Great Britain and also the potential demand for machinery shown in China alike justify such a step. Such a development is the more likely to accrue, as several China firms are now opening branches in London, and a more general and at the same time a closer connection is likely to exist in the future between such commercial interests and the actual manufacturers in Great Britain.

SOME CONCESSIONS TO CHINA TRADE.

Mr. Fox attaches great importance to the concession British manufacturers have just made to omit from their contracts the clause entitling them to higher prices to meet increased costs accruing whilst such contracts are being discharged. This removes a serious handicap to British trade in China, and will do much to maintain the high prestige British manufacturers enjoy amongst the Chinese. This prestige nothing should imperil.

The willingness now of British manufacturers to receive Chinese students in their works for technical training was matter for comment and congratulation on the part of Mr. Fox. Manufacturers in Britain realise now how much America has done in assisting the training of students; also what Japan has done, and the steps towards the same end which France is taking. The results of such a policy have also been brought home to manufacturing interests in Britain who, somewhat late in the day, are following a similar course, so that students may become expert in British methods and adopt British workmanship and products on return to their native country. Students, therefore, should now find no difficulty in obtaining entrance to engineering works in Great Britain to complete their engineering training, and movements are now on foot to assist students towards this end. At the same time Mr. Fox points to the necessity of students receiving a sound education either in their own country or at one of the technical colleges in Great Britain before seeking admission to works, and, in any case, application for such admission should be made through some official department such as the Chinese Legation or the Oversea Trade Department (Board of Trade), and should not for choice be made direct to the manufacturer.

Mr. Fox does not anticipate any difficulty so far as the financing of contracts is concerned. He is of opinion that such difficulties, as they refer to trade with China, are somewhat exaggerated, so far at least as the more important engineering contracts are concerned. British manufacturers are not likely to be handicapped in this respect. Nor does Mr. Fox think that the cost of British-made machinery is a deterrent to trade with China. Here, again, of course, the engineering industry alone is referred to. Considering quality of material, design and workmanship, Mr. Fox deems that British machinery offers good value for money, and on the price question has little to fear from foreign competition. In his opinion trading with Great Britain represents for China a thoroughly sound business policy, whilst for the British manufacturer China probably offers the greatest potential markets for machinery in the world. He considers that a very long period must elapse before China can supply her own machinery requirements. That this condition will ultimately obtain, he has no doubt, and it represents a development which is wholly legitimate and creditable. In the meantime, as China begins to manufacture for herself her market for machinery becomes changed rather than narrowed.

About the middle of December Mr. Fox leaves England on his return journey to China. It may be safely asserted that the outlook in China has been made clearer to British manufacturers by his visit; that by his visit many of the difficulties and doubts concerning Anglo-China trade have been removed or mitigated, and that the position is sounder and saner for his coming. This is much to have achieved in so brief a period, and very hearty congratulations may be tendered Mr. Fox on the assiduity of his endeavours and on their efficacy.

ENGINEERING, MINING AND INDUSTRIAL PROJECTS IN THE FAR EAST.

THE ANGLO-CHINESE CHARTER.

This Charter, it will be recalled, has been granted by the Chinese Central Government jointly to certain British and Chinese interests, empowering them to form a development company and conferring certain benefits for industrial development outside the Treaty Ports. Under the auspices of the Federation of British Industries a meeting has been held in London to explain to manufacturers its aims and possibilities and to consider steps by which the scheme can best be brought to fruition. The scheme is, of course, an industrial rather than a trading project. A small committee has been formed to investigate the whole question and endeavour to put forward practical measures. The following gentlemen have agreed to serve on this committee: –

Sir John Kemnal (Babcock and Wilcox), Mr. John Noble (Armstrong Whitworth), Mr. E. F. Oldham (United Glass Bottle Manufacturers), Mr. C. E. Tatlow (Lever Bros.), Mr. R. M. Bewick (United Alkali Co.), Mr. J. O. P. Bland, and Mr. S. Springer and Mr. H. Hobden, the last two gentlemen representing the Federation of British Industries

It is proposed to form what will be known as the Chinese British Industrial Corporation, and members of the F.B.I. are being invited to subscribe the necessary capital. Many large firms are responding. It is believed that only some £120,000 will be required to form the parent corporation, the main purpose of which will be to delegate the powers and privileges enjoyed under its charter to subsidiary or associate industrial undertakings. At present it is proposed that the parent concern should act as an intelligence bureau and exploration agency with the object of furnishing information or influencing Chinese capital and generally of acting as an intermediary when necessary between firms operating under the charter on the one hand and the Legation and Chinese Government Departments on the other.

CHINESE-AMERICAN BANK OF COMMERCE IN SHANGHAI.

The Chinese-American Bank of Commerce (Commercial and Industrial Bank of China), the formation of which was notified in these pages nearly twelve months ago, operating under special charter from the Chinese Government, has at length opened for business in Shanghai. It may be recalled that the bank was organised by a group of American financiers in co-operation with Chinese financiers, and has now offices in Peking, Tientsin, Chentow, Hankow, Harbin, and Manila. Branches in Tsinan and Canton are soon to be opened. Mr. Chien Nen-shun, a former Premier, is president, while Mr. J. A. Thomas and Mr. Hsu En-yuen are vice-presidents. Mr. H. A. Allen will be manager of the Shanghai branch. The capital of the bank is $10,000,000, half being subscribed by the American shareholders and half by the Chinese shareholders. The Shanghai office building has been completely remodelled and re-arranged for banking purposes.

RAILWAY AND ROAD CONSTRUCTION.

Industrial and constructional projects of some importance are likely to result from the famine relief measures now decided on. In Peking the Government has decided to employ about 1,000,000 hands on the construction of roads between Peking and Shantung, Peking and Honan, and other roads in Chihli Province, at an estimated cost of $200,000. The Chiaotungpu authorities have also decided to construct the Tsangchow railway, as a means of providing constructive employment. Elsewhere similar projects are being considered.

NEW FAR EASTERN TRADING CONCERN.

Under the title of Furness (Far East), Ltd., a new company has been registered in London with offices at 21, Billiter Street, with a capital of £30,000 in £1 shares, to carry on the business of shipowners and brokers, steamship agents, managers of ships, coal and coke merchants, importers and exporters of all kinds of merchandise, goods or produce, timber merchants, etc. The first directors are: Sir Frederick W. Lewis, Bart., Mr. S. J. Forster, Mr. H. E. Weddell, and Mr. N. Stockdale. The Far East business is to be under the control of a local Board, who shall meet only at Hongkong. The first members of the local Board are: Mr. L. Yates (chairman), Mr. G. Yates, Mr. T. W. Scarborough, and Mr. J. M. Gordon. Secretary: Mr. E. A. B. Forster.

NEW BRIDGE CONSTRUCTION.

The Minister of Communications has given instructions for plans and estimates to be drawn up for the construction of a new bridge across the Yellow River for the Peking-Hankow Railway.

Serious consideration is now being given to the project for replacing the International Bridge across the Haiho with a structure really adequate to meet the needs of the heavy and growing traffic at this point. It is proposed that, as a preliminary measure, the Foreign Municipalities, in the event of their admitting the necessity of replacing the bridge, should ask the Consular Body to take the question up with the Chinese Authorities and consider in detail the financial aspect of the matter.

PROGRESS AT WEI-HAI-WEI.

The Victory Pier, Wei-hai-wei, has been such a commercial success that a scheme has been recommended for the building of a sea wall and the making of a storage ground in its immediate neighbourhood, so as to facilitate the sorting of cargo on arrival and its storage whilst awaiting distribution or shipment. The estimated cost of the scheme is $40,000, which it is proposed to meet, as in the case of Victory Pier, by an increase in shipping dues. Despite the prejudicial effect of the boycott of Japanese goods and the refusal of the Chinese in the territory to handle goods emanating from Japanese sources, Wei-hai-wei was visited during last year by a total of 512 steamers, with a total net tonnage of 487,526, as compared with 519, with a total net tonnage of 442,236, in 1918. The total number of junks entering and clearing during 1919 was 4,535, as compared with 2,483 in the previous year, this increase being mainly due to the large importation of salt.

THE CH'AO-MEI INDUSTRIAL ESTABLISHMENT AT SWATOW.

Reporting on the Ch'ao-Mei Industrial Establishment at Swatow, Consul Myers states that the enterprise will be devoted to the manufacture of cotton goods and chinaware. Its proposed capital is $500,000 local currency, of which about $300,000 is reported as subscribed and paid in, about $100,000 having been raised in the Swatow district and the balance from Chinese in the South Seas. An administration building costing about $27,000 was recently opened. One hundred sets of American weaving machines for a power-driven plant have been ordered from an American firm in Shanghai at a reported cost of $100,000. A factory for the manufacture of chinaware on improved native lines has been started at Kaopi, one of the principal centres of the industry, but it is expected that later this manufacture will be developed along modern lines.

PROPOSED RAILWAY CONSTRUCTION IN KYUSHU.

Particulars supplied by H.M. Consul at Nagasaki show that it is proposed to construct the following new railways in the island of Kyushu:—

Section.	Length of line. Miles.	Estimated cost. Yen.	Time of construction.
Nagao-Haruda	13	5,240,000	1922-1927
Imari Sasebo	46	10,700,000	1922-1929
Tateno-Takamori	11	2,050,000	1921-1924
Hitoyoshi-Yumae	15	1,510,000	1921-1923
Oguchi-Sendai	39	4,720,000	1920-1926

Of these, that from Nagao to Haruda, on the main Moji-Kagoshima line, will link up the Chikuho coal mines with southern points. At present the only outlets of these mines are to the north in the direction of Wakamatsu and Moji, and the only access from the south is by a roundabout route *viâ* Oryo. The others, though connecting with points on the main or subsidiary lines, are light railways.

That from Imari to Sasebo is to go round the peninsula, which has Imari and Sasebo on the north and south side of the neck. Opposite the peninsula is the island of Hirado; there are a number of small islands in the neighbourhood, and the Goto Archipelago in the distance. Produce from the islands consists of litle more than fish and timber, but there is coal on the mainland. Imari is, of course, the port from which Arita ware was formerly exported, while Sasebo is the naval port.

Tatano is a point on the line, running east from Kumamoto towards the east coast, which has been carried as far as Miyaji (rather less than half-way across). Communication between Eastern and Western Kyushu is badly hampered by the range of mountains running roughly north and south through the island. The only line which has penetrated from west to east hitherto is the very devious route from Yoshimatsu, on the trunk line from Moji to Kagoshima. This line from Yoshimatsu runs to Miyazaki on the east coast, capital of the prefecture of the same name. The proposed line from Tateno to Takamori is to tap a prosperous valley west of the main range, and it and the proposed line from Hitoyoshi, on the trunk line to Yumae, may be regarded as "feelers" which may eventually be linked up with the east coast.

The last line mentioned will link up an important mining district in Kagoshima Prefecture with the branch line from Kagoshima to Sendai.

Compared with other parts of Japan, Kyushu, south of the prefectures on Fukuoka and Oita, has progressed but slowly. The main reason has been the mountainous nature of the country. While this must always hinder progress, improved communications should in course of time materially increase its prosperity.

NEW INDUSTRIAL ENTERPRISES IN JAPAN.

According to researches made by the Department of Commerce and Agriculture, the number of industrial companies established during the first six months of this year is 1,600, whose total capital amounts to 236,246,152 yen. The figures mentioned show an increase of 482 in number and of 167,276,750 yen in capital, as compared with the corresponding period of last year. The number of the industrial companies floated during June is 228, whose total capital amounts to 65,840,950 yen. The figures mentioned show a decrease of 11 in number, but an increase of 31,303,400 yen in capital, as compared with the previous month.

AIR MAIL SERVICE IN JAPAN.

The Japanese Government has completed all arrangements for the early inauguration of a comprehensive air mail service throughout Japan. With characteristic thoroughness and attention to detail official reports have been prepared dealing with every phase of the aviation industry in Japan as well as statistics relating to pilots, aerodromes and suitable landing places. Aeroplanes capable of carrying four passengers in addition to mails and up to 6 cwt. of freight are said to be recommended for adoption by Mr. Oyamada, of the Japanese Transport Department, who was commissioned to study European methods of commercial aviation. Tokyo and Osaka are expected to be the first cities to be put into regular communication by air, and the Japanese Imperial Aviation Society is to be entrusted with the inauguration of all the new air routes.

DEVELOPMENTS IN STEAM TRAWLING INDUSTRY.

During the war all except six of the steam trawlers in Japan were taken over by the Allied Powers. At the present time there are 30 trawlers in all, averaging from 250 to 280 tons, of which the greater number have been built within the last year. Licences have been granted by the Government for a total of 60 vessels of not less than 230 tons, the number of licences to be increased if prospects warrant to a maximum of 70. It is expected that the number of vessels afloat by the end of 1920 will be over 40, and it is stated that 70 vessels is the maximum that the industry will support.

The new vessels of the Kyodo Trawling Co. are being built by the Osaka Ironworks (a shareholder in the concern) on very favourable terms. Five of the boats have wireless telegraph installations for the purpose of co-ordinating operations, and more especially of conveying information to the vessels at sea as to the best markets to which to bring the fish, so as to secure maximum prices. There is a scheme on foot for combining the whole trawling industry into one trust, controlling not only fishing operations, but also ice factories, coaling facilities, and marketing operations

STEAMER LINE TO KARAFUTO.

Advices recently to hand from Tokyo refer to the regular steamer service to Karafuto, the Japanese portion of Saghalien, that has been established, with a view to maintaining traffic communications between the main island and Karafuto during the winter. For this purpose the construction of a new type of ice breaker, with wireless equipment, a speed of 20 knots, and 2,700 tons displacement, has been ordered. The ice breaker is expected to cover the distance in less than four hours. It is believed that the maintenance of this service will contribute considerably to the welfare of the islanders and to the future development of the north-western territory.

VEGETABLE OIL INDUSTRY IN JAPAN.

Details to hand indicate that Japanese interests are advocating certain projects for the development of the vegetable oil industry. The report emanates from Kobé, the centre of the oil-crushing industry in Japan. It is not possible to obtain definite particulars, and the news is probably founded on certain minor extensions to existing mills and on the optimistic outlook now generally adopted in the industry, particularly in its relation to the treatment of rubber seed. The majority of the mills in Japan are equipped to deal with a wide variety of vegetable oil-seeds by slight adjustments of the machinery. The majority of the mills employ the pressure method of oil extraction, using one of three types of hydraulic-pressure machinery: (1) The round-bed type, with a bed about 18 in. in diameter, used for beans and rape-seed; (2) the oblong, flat-bed type, about 30 by 14 in., used for pressing copra; and (3) the bowl type, in which a stone bowl is pressed into a mass of seed pulp held by iron hoops, used in second and third pressings of peanuts and beans. One mill is reported as using an American rotary-type screw expressor, and a few have adopted the benzine-extractor process.

OIL PROSPECTING IN BORNEO.

Some time back it was announced that Japanese interests had secured prospecting rights in Borneo for oil prospecting on a large scale. The company sent several experts to the scene of operations some months ago for preliminary surveys, and these have already reported favourably. A number of boring machines have now been landed in Borneo and will soon be in operation. It has been considered possible that some of the equipment utilised by the Kuhara Company in its petroleum prospecting in Sakhalin might be transferred to Borneo, but in view of the more recent Japanese occupation of the Siberian province, it is not now expected that the search for oil in this territory will be abandoned.

The Government on its own part has been very active in the search for oil deposits, owing to the recent decline in the output of petroleum in Japan. Government officials stated that the decline in output was in part due to the cessation of imports of iron tubing and boring machinery, but coupled with this are indications that the fields in Niigata Prefecture are on the down grade. Akita Prefecture is expected to show an increased output, but not sufficient to compensate for the declining tendency in Niigata.

FIELD FOR MERCANTILE ENTERPRISE IN THE DUTCH EAST INDIES.

In an address given in London by Sir Walter Townley, K.C.M.G., attention was drawn to the field for mercantile enterprise developing in the Dutch East Indies, largely due to the industrial projects being promoted or in hand in this part of the world. As a consequence, a demand exists for machinery of all sorts, building materials, and metals; special openings exist for the importation of locomotives for various duties. The machinery needed is to some extent for agricultural purposes; motor-cars are also required. American and German competition is keen in the locomotive and motor sections. It is hoped shortly to establish exhibitions for furthering Netherlands Indian trade. Good work in advocating British interests in the Netherlands Indies is being accomplished by the British Chamber of Commerce for this territory in London, of which Sir Walter Townley is Governor.

The proposals for the development of railways during the next ten years include the completion and doubling of existing lines and the building of new railways in Java and Sumatra, whilst plans for the construction of lines in the islands of Celebes and Borneo are also under consideration.

A perfume factory has been established at Wonokromo (Java), where Oriental perfumes will be made suitable for Western use. This undertaking is being run in conjunction with a soap factory.

PUBLIC WORKS IN SINGAPORE.

Within the next few months it is expected that Government will begin work on two important public buildings in Singapore, the new General Post Office and the new General Hospital, plans for which have been prepared by Major P. H. Keys, D.S.O., M.C., Government Architect.

The Singapore Municipality proposes to spend $21,500,000 on the improvement of the local water supply. New pumping stations, reservoirs, and extra mains will be erected, and there will be opportunities for British manufacturers to supply material. The work will be spread over seven years.

PRODUCTION AND TRANSMISSION OF COMPRESSED AIR.

The industrial activity foreshadowed in the Far East includes industries such as mining and shipbuilding in which compressed air is largely used. In fact, the uses for compressed air are legion, and a large potential market for the production and transmission plant will develop. In these circumstances special interest will attach for many readers to the following article, which represents the abstract of a paper read by Mr. John T. Pringle before the North of England Institute of Mining and Mechanical Engineers. Literature on compressed air is not very voluminous, some of the best and most recent emanating from America, but Mr. Pringle embodied in his address much practical information and a valuable *résumé* of modern practice.

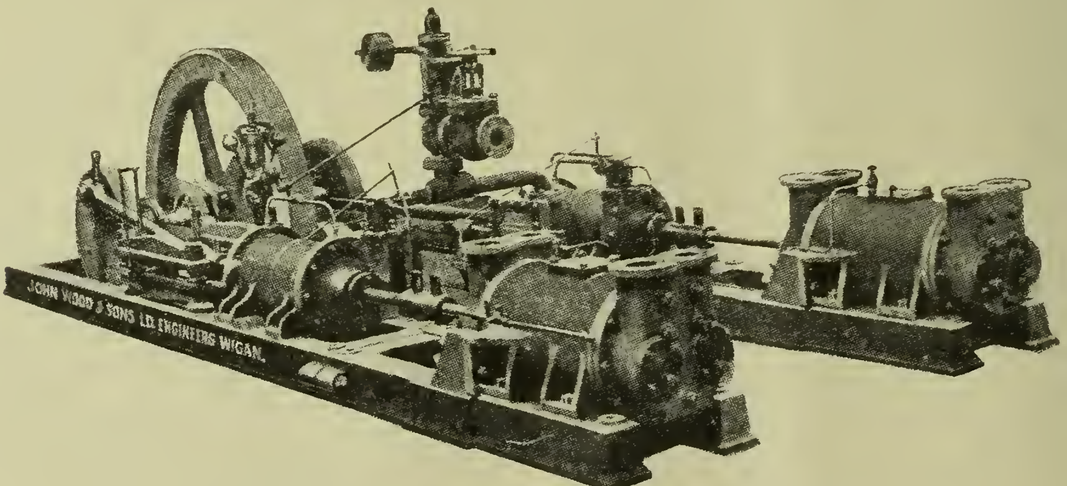
As the pressure to which air is compressed varies with the volume, compressors are rated, not from the amount of their product, but from the amount of air drawn from the atmosphere. Considerable heat is generated during compression; means of cooling the compression cylinders are therefore provided, and for high pressures the work is done in two or more stages.

Conditions to be fulfilled in a perfect compressor are:—(1) The primary power must be reliable and efficient. It can be in the form of (*a*) a single or compound steam or water engine of the slow-running type with Corliss or drop valves, or (*b*) a high-speed overtype compound engine of totally-enclosed design, or (*c*) some form of electric motor, geared, belt or rope-driven, or directly coupled to the compressor crankshaft.

(2) The suction stroke of the compressor should throughout its length fill with air at atmospheric pressure.

(3) On the compression stroke there should be no loss of any portion of the contained air by reflux to the atmosphere by too late closing of the inlet valves, nor should there be any leakage back, but the whole contents of the cylinder, less the minimum of clearance, should be discharged through the outlet valves.

(4) The outlet or discharge valves should have ample area of opening, should open automatically on the pressure in the receiver being reached in the compression cylinder, and the air should be discharged at a pressure as little above that in the receiver as possible, as excess pressure causes a rise in temperature with increase in volume, requiring a corresponding increase in the work necessary to compress and discharge the air.



Duplex Air Compressors by John Wood & Sons, Ltd., Wigan.
Light Disc Valves and Speed and Air Pressure Control.

(5) The discharge valves should have sufficient width or seating to ensure their keeping quite tight, so that no loss by leakage back into the cylinder may take place.

(6) The valves should be self-adjusting under all speeds and pressures.

(7) All valves and the piston should be easily accessible for examination and renewal.

(8) Full volumetric efficiency.

(9) Wear and tear should be reduced to a minimum.

(10) An efficient unloader must be fitted.

(11) A good flywheel.

(12) An efficient governor.

Broadly taken, we have three types of compressors:—(*a*) The horizontal slow speed; (*b*) the vertical quick-revolution; (*c*) the turbo. The durability of type (*a*) and its accessibility of repairs and adjustment make it the most popular for mining work, but it requires larger foundations and buildings. The vertical quick-revolution type (*b*) has the advantage over the horizontal type in the space occupied, but its general inaccessibility and its heavy upkeep are against its adoption. The turbo compressor (*c*) is chiefly used for very large capacities, and owing to its high speed, motors of moderate dimensions can be fitted. The efficiency of turbo compressors has been greatly improved, but it is even yet questionable whether they are as efficient as reciprocating compressors, taking power for power. Moreover, in mining work compressors often run much below full load, and the efficiency of the reciprocator under these conditiens is much higher than the turbo.

Air compressors may broadly be classed according to the manner in which their inlet and discharge valves are actuated, viz.: (1) In which poppet valves are used for the inlet and discharge (*a*) in the cylinder covers, (*b*) partly in the covers and partly in the cylinder walls, (*c*) with inlet valves in the piston and discharge valves in the cylinder covers or walls. (2) With mechanically-operated inlet and discharge valves which open and close gradually, through direct connections. (3) With large hinged flap valves arranged in the covers and actuated as poppet valves. (4) With mechanically-operated inlet valves and with poppet valves. (5) Direct air-controlled and balanced inlet and discharge valves. (6) Light disc valves with small lift.

By the use of direct air-controlled valves the efficiency is improved, and increasd piston speeds can be obtained, but, owing to the high initial cost and necessity for maintaining the valve gear in a perfect state, the system has not been generally adopted.

There is no doubt, however, that the last-named system has proved the best all round, giving as it does great efficiency with the highest piston speeds; lightness, hence low inertia; ample port opening with small lift; fluid tightness; durability; and easy access for examination.

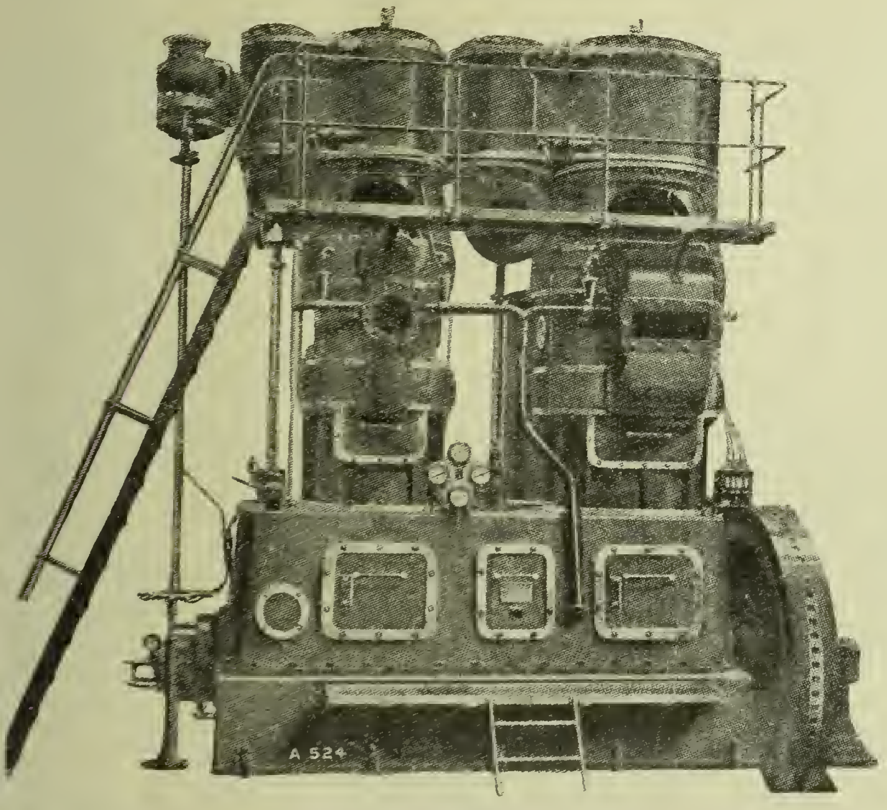
Steam cylinders in compressed air plant have either a plain slide valve with or without "Meyer" adjustable cut-off, Corliss valves, drop valves, or balanced-piston valves. The first is used chiefly on straight-line compressors. The second is used on large engines, both straight-line and duplex, and is well adapted for a compressor service. The third is used also for large engines working with high-pressure steam and superheat, and is of the double-poppet type lifted by cam and closed by spring. It is nearly balanced and the running speed of the compressor may be higher than in Corliss engines. It is preferable that the steam-valve gear be made adjustable while the engine is running, so that the cut off can be varied at will.

The economy and success of two-stage compression depends upon the intercooler. When perfect, the intercooler should keep the high-stage intake air at the same temperature as the lower-stage intake air, and efficient intercooling is said to be done when air is cooled to within 20 deg. Fah., of the entering cold-water temperature. The water for the intercooler should be 2½ gallons per minute per 100 cub. ft. of free air, or more if it is available from the supply. It is known that for every 10 per cent. decrease in the temperature of the air delivered to the high-pressure cylinder, the power required for compression is decreased 1 per cent.: consequently it is up to users and engineers to have stage compression in every case, for it is a recognised fact that there is a saving of 8 per cent. taking work for work in single and stage compressors.

The lubrication of the air cylinder is not so well understood by the average engineer in charge of the plant, and a few notes here may be helpful.

The general theory is that a light oil of low viscosity is of little use, as it will not withstand the heat of compression. Many tests have been carried out to discover the best oil for this service, and many use a low-viscosity oil with a flash-point above the temperature of the air, with the resultant carbonisation of the passages, samples of which have been found to contain 1.5 per cent. of free oil, 11 per cent. rust, 5 per cent. decomposed oil, 30 per cent. mineral ash, 10 per cent. of coal dust, the remainder foreign matter and residuum. However, an investigation of the intake pipes and air is often a great help in deciding the class of oil to use, and if the air is clean, for a light compressor, say 14 in. by 14 in., an oil with a flash-point of 375 deg. Fah., burning point 420 deg. Fah., and viscosity of 200 at 100 deg. Fah., and fed in at three drops per minute, is all that is required.

The carbon deposits in compressors are in many instances due to using an oil of heavy body which adheres to the passages of the cylinder, and with unfiltered intake air, dust, and other matter is drawn in and deposited on the sticky surfaces, which in time choke the passages, causing valves to leak, and temperature to rise, until it may reach 500 deg. Fah. when compressing to 100 lbs. per sq. in. The deposit then becomes incandescent, again increasing the temperature until one gets what is termed an explosion. In the author's opinion no violent explosion ever takes place in a compressor unless kerosene, petrol, or some such material is introduced. It will be seen from this that an oil with flash-point 375 to 400 deg. Fah., and viscosity 140 to 150 at 100 deg. Fah., is all that is required, with one drop for each 600 sq. ft. of cylinder surface, and, say once a week, a liberal quantity of soap and water fed into the cylinders.



Steam-Driven Compressor by Messrs. Alley & MacLellan, Ltd., Glasgow.
Capacity: 5,000 cubic feet per minute.

The receiver should be placed within 40 or 50 ft. from the compressors. Its use being (1) to eliminate pulsation effect; (2) to minimise the frictional loss attending the flow of air in the lines; (3) to serve as a reservoir; and (4) to cool the air and cause it to deposit its moisture. The first and fourth functions are obvious. The second function is best fulfilled by placing an auxiliary receiver near the point where the air is being used, and as the receiver at the compressor diminishes the momentary rise in the main, so the second receiver will prevent any sudden fall in pressure as the different machines are put on.

An official cablegram from Kuala Lumpur states that the exports of rubber from the Federated Malay States in the month of October amounted to 8,323 tons, as compared with 7,604 tons in September, and 8,381 tons last year. The total export to the end of October was 88,585 tons, as against 88,205 tons last year and 64,043 tons in 1918.

THE YAWATA STEELWORKS IN JAPAN.

The Government steelworks at Yawata (Kyushu) in Japan has been reported upon at some length by the Commercial Counsellor of the British Embassy, Tokyo.

The report sets out that the town where the works is situated has gradually expanded until it now contains a population of over 100,000, about 20,000 of whom are employed in the steelworks, which supply one-third of the quantity of steel on demand in Japan. Over 60 per cent. of the ore used is imported from China. In 1899, when the works opened, they made a small profit only, and for the subsequent ten years there were continued losses. It was only in 1910 that the tide turned. In the three years 1916-1918 the profits aggregated 133,940,000 yen (say, £13,400,000), which left a surplus of nearly £5,800,000, after building and other costs up to 1918 had been deducted.

The quantity and value of steel sold in 1917 was 297,000 tons, and in 1918 310,000 tons. The production of pig-iron has declined from 302,000 tons in 1916 (the highest point of production) to 269,000 in 1918 and in 1919. On the other hand, the output of steel has increased from 282,000 tons in 1916 to 437,000 tons in 1919.

The present full capacity of the works for the production of steel is about 700,000 tons; but when the extensions now in hand are completed the actual annual production will probably be 750,000 tons. Of the pig-iron for making this 750,000 tons, the management propose to make two-thirds themselves and get the remaining third from outside. In this way some 1,000,000 tons of ore will be required. The ore required for 1919 was estimated at 860,000 tons, of which they intended to get 550,000 tons from China and 310,000 tons from Korea and Japan, but the expected quantity not having been obtained, pig-iron was produced only to the extent of about 270,000 tons. The principal source of ore for the works is Tayeh, in China, but the works own two mines in the Hwanghai Province (Korea), and have recently acquired two mining concessions in Echigo.

There is also some difficulty about the coke. The quantity of coal now consumed at Yawata, both as fuel and for converting into coke, is 1,690,000 tons, of which about 700,000 tons are supplied from the Futase Colliery belonging to the works. After prolonged experiments they have succeeded in making moderately good coke from coals from various sources. On the completion of the extensions now in hand it is estimated that 1,000,000 tons of good coal will be required annually for coke-making and 1,500,000 tons for fuel.

The number of workers employed is 22,853 (exclusive of officials). The average wages of workmen are about 55 yen (about £5 12s. 3d.) per month, and those of coolies (including women and youths) are 1.54 yen (about 3s. 2d.) per day. The works has adopted an eight-hour day.

Thirty-six British and foreign Governments have now signified their intention of taking part in the fifth international exhibition of rubber and other tropical products, which, under the patronage of the King, will be held in London next June.

Hadfields, Ltd., of Sheffield, have issued £1,000,000 7½ per cent. first mortgage debentures. The stock is to be issued at 98 per cent. and is to be repaid on February 1, 1931, at 102 per cent. The issue was largely over subscribed.

Japanese trade returns show that in August last the imports of rubber represented a value of 623,000 yen, as compared with 1,550,000 yen in the corresponding month of last year.

The directors of Henry Berry and Co., Ltd., hydraulic engineers, of Leeds, announce a final dividend of 10 per cent., making 20 per cent. for the year.

Babcock and Wilcox, Ltd., are paying an interim dividend of 7 per cent., free of tax.

DEVELOPMENTS IN MOTOR SHIP-BUILDING.—II.

THE PRESENT POSITION OF THE MARINE DIESEL ENGINE.

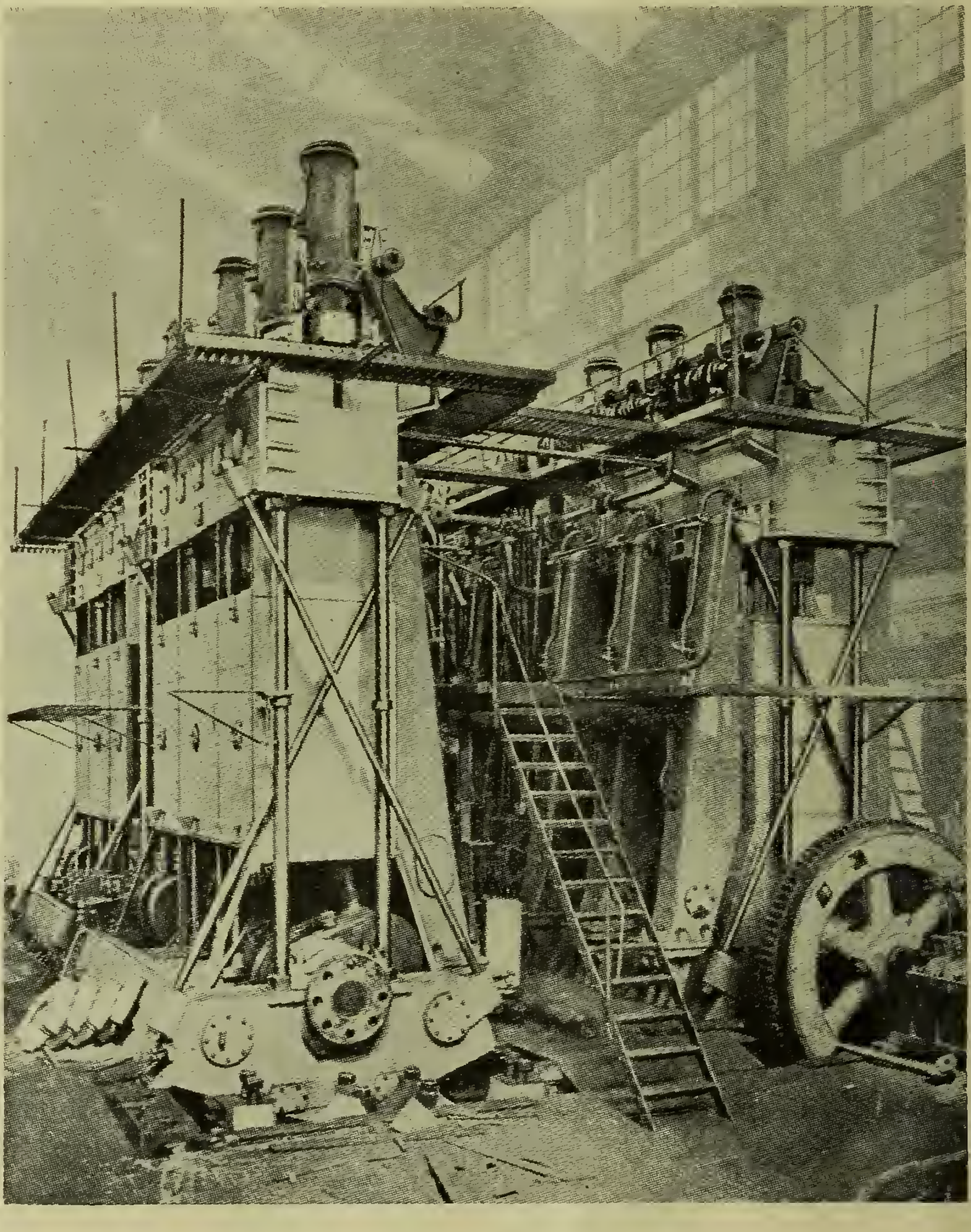
The present position of the Marine Diesel Engine was clearly indicated by Mr. James Richardson, B.Sc., in a lecture recently delivered to the Institution of Engineers and Shipbuilders in Scotland, although the paper and the discussion which followed centred rather too freely on the familiar topic of the respective merits of the two- and four-stroke engines. Mr. Richardson briefly touched on the claims of the Diesel-electric system of propulsion, which he contended will receive much more attention than hitherto and may prove the most secure path towards high power. Whatever the merits of steam-electric marine installations, the case for the Diesel-electric is much stronger. Captain William P. Durtnall is the founder and promoter of what is now generally known as the "Paragon" Thermo-electric system of propulsion. Captain Durtnall is consulting engineer to the Thermo-electrical traction department of Messrs. Hawthorn, Leslie & Co., Ltd., of Newcastle-on-Tyne. We give in this issue particulars of the system he courteously supplied us with at a recent interview. The system, moreover, was outlined by him in a paper he read a short time back before the Keighley Association of Engineers. Captain Durtnall is also the inventor of the "Paragon" cycle for Diesel engines, which is dealt with later.

Referring again to Mr. Richardson's lecture, the author showed that the most important of the problems of design are common to both two- and four-cycle engines and the first concerns the injection of the fuel into the working cylinder. The exact quantity of fuel, at a pressure sufficient to ensure injection, must be measured out by the pump and spread in some 30 degrees of revolution as widely as possible into the combustion space, in a sufficiently finely divided state to ensure rapid ignition and satisfactory combustion. Chiefly in this direction of improving distribtion of the fuel in the combustion chamber can increased economy be sought.

There are two alternative methods of spraying; one by means of compressed air, the other by injecting the fuel at a high pressure known as the solid injection system, illustrated in our last issue. The utilisation of compressed air is most general. So far as marine installations are concerned, the principal advantage of the solid-injection method, where compressed air is not used to assist injection, and is only required for supplying manœuvring power, is that the compressors are not a part of the main propelling engine and do not require to run continuously at sea. Moreover, the air-compressing plant, where solid injection is adopted, can be reduced by from 40 to 50 per cent. in capacity.

Reliability with air compressors delivering at 850 to 1,000 lb. per square inch has now reached a high level, the leading factors towards this end being generally appreciated, and air-compressor problems rated at their full value. Multi-staging is essential, and compression to 1,000 lb. per square inch should be carried out in not less than three stages, so proportioned that no undue ratio of compression and consequent temperature can occur in any stage.

The other fundamental of injection, the measuring of the oil fuel, involves the most delicate apparatus associated with the Diesel oil engine—the fuel-injection pumps and controlling gear. The system of having one pump per cylinder is now almost universal for marine work (excepting where solid injection is used), and only in this way can the maximum security against a large percentage of overcharge and overload in one or more of the cylinders be obtained. These individual pumps, therefore, become of relatively small size. Even with separate pumps, continual care and intelligent supervision must be exercised to ensure that the deliveries from the pumps are maintained equal, lest one or more cylinders should be overloaded to counteract the effect of diminished deliveries from defectively working pumps. Means are now generally provided whereby any pump can be cut out and overhauled whilst the remainder are in operation.



Illustrating the Construction of a pair of 1,400 I.H.P. Werkspoor Reversible Marine Diesel Engines.

Even with the progress made in design during recent years there has been generally an increase in weight and space occupied by the slow-speed Diesel engine per horse power developed continuously. The causes, of course, are the temperature gradient through the metal surrounding the combustion chamber and the fact that the major portion of the material of the engine is only utilised for a small fraction of the running time. The former refers more particularly to the two-cycle engine, which, however, as a speaker at Mr. Richardson's lecture pointed out, has a smaller temperature *range* than the four-cycle, because the idle strokes of the latter means that a certain amount of cooling of the cylinder walls takes place, which is obviated in the former having an explosion every revolution. The drawback of weight applies more especially to the four-cycle engine, where three-quarters of the running time is idle so far as power output is concerned. Moreover, of the one-power-stroke per two revolutions, only one half of this stroke, or 12.5 per cent. of the cycle stresses the ports of the engine comparably with their strength and scantlings. It is interesting to note that comparing Diesel engine and steam engine of normal design and equal power, the maximum normal load with the oil engine is more than five times as great and the *rate* of application of this main load is increased ten times. With internal combustion the normal stresses are liable to sudden increases, calling for a larger factor of safety, and design questions relating to the main ports of the engine must be considered strictly in this light.

The simple design of liner for Diesel engine cylinder adopted up to the present with all but a few exceptions, cannot be approved on theoretical grounds. To obtain a minimum value for the combined stress consequent upon temperature gradient through the metal and internal pressure, a ribbed and built-up form of construction must be adopted. This can be simply accomplished, as is sometimes the case, with the four-cycle engine, but imposes greater difficulty in the case of the two-cycle, where exhaust and scavenging ports have to be accommodated in the cylinder. Mr. Richardson, who is an advocate of the four-cycle engine, urges that computation of the high stresses with the two-cycle cylinder in the way of the scavenging air-inlet and main exhaust ports is extremely difficult. These are bound to be very considerable in view of the high velocity of the exhaust gases and the consequent high rate of heat transmission from these gases to the walls, and are further intensified by the cooling and distorting effect of the entering scavenging air with the normal two-cycle design.

The Motor Ship “ Vulcanus, the first Ocean-going Full-powered Diesel ship (Werkspoor 650 I.H.P. engines) for the Anglo-Saxon Petroleum Company.

For the better utilisation of materials than is achieved with the four-cycle engine, the two-cycle single-acting, the four-cycle double-acting, the opposed pistons construction, the two-cycle double-acting principles, or the combined effect of oil and steam, as with the " Still " engine, are put forward. In these circumstances, short cuts to achieve reduction in space, weight and cost are not advisable. Increased experience, better materials, more efficient utilisation of such masses as are required to cope with the pressure of the cycle, together with standardisation, will in due course effect a reduction in these disabilities.

The comparative high cost of the Diesel engine is, of course, minimised by the greater cargo-carrying capacity possible by the adoption of oil engines, or, alternatively, by the fact that a smaller Diesel-engined ship serves to give equal earning capacity. The economy of the oil engine is such that extra first cost is speedily balanced by the increased profits obtainable.

That reliability can be obtained with the Diesel engine will not be gainsaid. The position of this new prime-mover is not yet, however, sufficiently secure for short-cuts towards the lightening or cheapening of the engine to be undertaken without the most careful consideration. The available knowledge demands that oil engines shall be rated at a moderate power-output per unit of swept cylinder volume with the consequent low-temperature gradient through, and stresses in, the metal exposed to combustion temperature. Ample strength and rigidity must be given to those parts that are stressed by the pressure of the cycle, and a high quality of workmanship is essential for all the principal units. So long as labour conditions do not very appreciably change, the Diesel oil-engine will increase rapidly in importance, with the full realisation of the enormous advantages of liquid fuel as a marine combustible. Satisfactory distribution of fuel throughout the world seems assured, and any future shortage will first affect those plants less able to compete in regard to economy of consumption of liquid fuel. Powers up to 6,000 or even 8,000 brake horse-power per ship with twin screws (500 brake horse-power per cylinder) can be looked for in the very near future, and gradual increases will take place successfully by short steps consolidating each advance before proceeding to the attainment of higher outputs. With increasing size of cylinder altered methods of construction will be called for.

It is pleasing to reflect that in Britain there are under construction a larger variety of types of marine oil engines than in any other country, indicating an enterprising and progressive policy of determined trial. The longed for internal-combustion turbine does not yet appear on the horizon. The relative inefficiency of high-pressure turbo-compressors, the losses consequent upon the transference of the working medium from the compressor to the turbine, and the difficulties experienced with available materials when subjected continuously to the high temperatures necessary for economy, have so far been insuperable barriers to development.

THE "PARAGON" CYCLE FOR INTERNAL COMBUSTION ENGINES.

Reference has already been made to the " Paragon " cycle invented by Capt. W. P. Durtnall. This cycle has been designed to meet the difficulties in gas and oil engine practice of high pressure and temperature of exhaust gases. It places the inlet and exhaust valves in such a way that the travel of the piston during expansion of the charge is twice as long as its travel during compression. It is put into practice without in any way affecting the regularity of the mechanical stroke of the piston, which is always of the same length. The principle is applicable to both two-stroke-cycle and four-stroke-cycle Diesel, as well as all kinds of gas engines.

Fig. 1 shows a section of a Diesel pattern engine of the two-stroke-cycle type using the " Paragon " cycle. Besides the fuel valve there is a valve to admit air for scavenging, both in the cylinder cover and the exhaust valve is a sleeve covering a ring of ports around the middle of the cylinder, and operated by a rod from the crankshaft. The cycle is as follows:—

Starting with the piston at the top of the compression stroke, and the crank on the inner dead centre, as shown, the air in the compression space is at a pressure of about 500 lb. per sq. in., and a temperature of about 1,000 deg. F. As the crank passes the centre, the fuel oil is sprayed into the compression space and immediately ignites, continuing to burn and to maintain the pressure over a portion of the working stroke, as in the ordinary Diesel type. After the fuel is cut off, the gases expand until the piston reaches the end of its stroke, the exhaust ports being closed by the sleeve; at the end of the stroke the gases are almost at atmospheric pressure and a comparatively low temperature, and the exhaust valve now being opened, they escape almost noiselessly. The air scavenging valve is now opened, and a rush of air through the cylinder and out of the exhaust ports sweeps away the products of combustion, until the piston on the return stroke covers the exhaust ports and begins to compress the charge of pure air trapped in the cylinder. The rise of pressure closes the air admission valve, and at the end of the inward stroke the cycle is repeated.

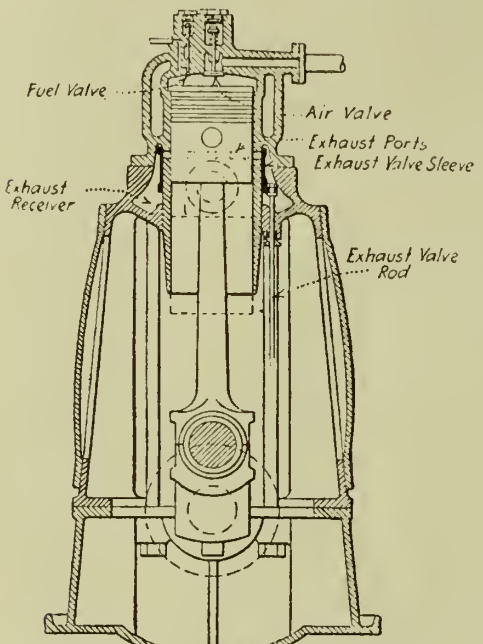


Fig. 1.—Section through Engine.

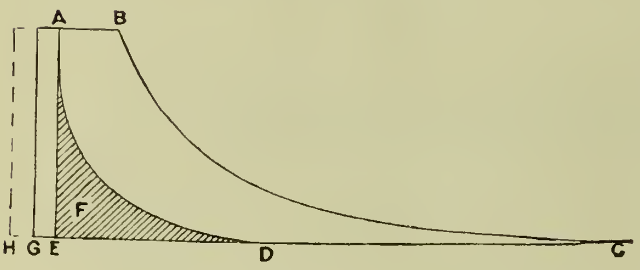


Fig. 2.

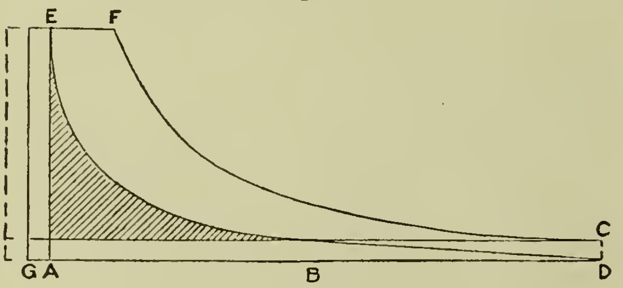


Fig. 3.

It will be seen that the expansion stroke is twice as long as the compression part of the stroke. The indicator diagram obtained is shown in Fig. 2, the stroke being represented by the length *EC*. In an ordinary Diesel engine with this length of stroke, the compression space would correspond to *EH*, but in the "Paragon" engine the compression space is reduced to *EG*, and compression does not begin until the piston arrives at the point *D*. At *A* compression is complete, from *A* to *B* the fuel is burning, and from *B* to *C* expansion takes place, release occurring at *C*. The shaded area *F* represents the work of compression, the remainder of the diagram being a measure of the useful work done on the piston.

Fig. 3 shows the diagram of a "Paragon" engine working on the four-stroke-cycle. In this case compressed air is not used for scavenging. On the suction stroke, from *A* to *B*, air is drawn into the cylinder; at *B* the induction valve is closed, and the pressure in the cylinder falls below atmospheric pressure, as shown by the line falling from *B* to *D*, the effect of the difference of pressures on the front and back of the piston being to check the motion of the piston and the parts attached to it, and on the return stroke to accelerate these parts, thus cushioning the stroke as in a steam engine, without appreciable loss of energy. At *B* on the return stroke compression commences, and at *E* it is complete; the fuel is then sprayed in, and burns during the working stroke up to the point *F*, after which expansion proceeds to the end of the stroke at *C*. The exhaust valve is opened as the crank passes the centre, and on the return stroke the piston sweeps out the burnt gases, the cycle being then repeated. Evidently the same effect is obtained as in the case of the two-stroke-cycle engine.

Owing to the reduced wall surface of the compression space, it is claimed that less heat is lost to the jacket, and the longer expansion permits a larger proportion of the energy to be abstracted from the gases, so that an increased thermal efficiency is obtained. The engine can also be worked on the "Beau de Rochas" or "Otto" cycle, in which the compression pressure is only about 80 lb., the engine being run with gas, with very great fuel economy, and real silent operation. The invention has been patented in most countries; patents have been granted quite recently in Germany.

THERMO-ELECTRIC SHIP PROPULSION.

In view of the developments which have been taking place in America and in Sweden and the practical consideration now being given to the matter in Great Britain there is every probability that the thermo-electric system of ship propulsion is likely shortly to come into its own. The inventor of this system, which is known as the "Paragon" system of ship propulsion, Captain William P. Durtnall, M.I.Loco.E., M.I.Mar.E., lectured on this topic before a recent meeting of the Keighley Association of Engineers, and we have been able to supplement the information submitted on that occasion by a lengthy interview with Captain Durtnall at his London office. Although for the purpose of this article the system is considered in relation to ship propulsion, it is applicable to locomotives and road vehicles. The first locomotive using this system is now under construction in the works of Messrs. Hawthorn, Leslie and Co., Ltd., to whose thermo-electrical traction department Captain Durtnall acts as consulting engineer.

The system was publicly introduced by Capt. Durtnall at the Franco-British Exhibition in London in 1908. During recent years a great deal of instructive experimental work has been done not only in Great Britain but abroad and with both steam and internal-combustion prime-movers, particularly in America and Sweden. Some of the largest and most powerful warships and some of the most efficient cargo-carrying vessels are now at work or are building which are fitted with this method of propulsion. The inventor urges that many of the heaviest duties of the world's industrial activities are carried out commercially and efficiently by the use of electrical power, so why not the duty of the propulsion of ships? In no industry other than the mercantile marine—with perhaps the exception of the railway industry—is there such a small return from the heat energy of the fuel burnt. Roughly, for every 100 shovels of coal put on the boiler bars only about six are actually doing work in the propulsion of the ship, the intermediary losses being as much as 94 per cent., brought about by the use of steam machinery, with its boilers, steam pipes, engines, condensers, thrust block and propeller losses. The *Lusitania* when at full speed had to expend no less than 68,800 horse power by means of her steam turbines on the propeller shafts to obtain a speed of about 25½ to 26 knots, for which there was required a thrust or effective horse power of only 33,000. The propulsive efficiency, as compared with the brake horse power, was only 48 per cent. Indeed, the thermal dynamic propulsive efficiency, as compared with the heat energy in the fuel consumed, was probably not more than 4 per cent.

The employment of electricity for the commercial propulsion of large ships had to await the period when current could be generated cheaply aboard. This period probably started about twenty years ago, when the development, design and construction of high-speed turbines and internal combustion engines began to take serious form in large output capacity. As matters developed it became evident that transmission of the power could best be obtained by polyphase alternating current machinery, with which there is no limit to the power that can be easily handled, and this type is being used on all powerful thermo-electric ships to-day. Results and developments were worked by Captain Durtnall into a system for use with high-speed prime-movers on self-contained vehicles, which cover ships, locomotives and road vehicles. Patents were applied for in twenty-four countries in 1905, in which nineteen were granted, recognising same as the basic patents for the thermo-electric self-contained propulsion system. For this system Captain Durtnall has been awarded two Gold Medals, one in 1908 from the Institution of Marine Engineers, and the other from the Society of Engineers in London in 1912. The system embodies the use of polyphase alternating current power transmission, and by its use the high-speed steam turbine can be put to service at sea and the economies which were evident in shore installations are to be obtained on sea-going vessels.

The system also brings into use the very efficient light weight, high speed, non-reversing internal combustion engine. These prime-movers can be always run in one direction independently of the speed or direction of the vessel, and the system brings into play for the first time in marine engineering history the means by which several engines can be coupled together, concentrating their joint energy into one propeller shaft. When travelling at a lower speed the power can be generated by means of one out of three prime-movers, and this one still running at full load with the other two shut down, and at the full power revolution speed with all its consequent fuel economy, compares well with the wasteful system by which all the prime-movers have to be slowed down, putting their consumption up very considerably when the vessel has to travel at half speed. It provides the ideal control from the bridge or engine-room, and brings into play a feature of increasing the safety of vessels at sea, by the fact that a "full-power" reverse is immediately at the disposal of the captain by pressing a button, or turning the handle of the master-controller on the bridge. The system also presents the acme of simplicity in the layout of the plant, which can be placed in almost any part of the ship, and not necessarily in line with the propeller shafts. The very much higher thermal efficiency of modern high speed superheated steam turbines can be utilised by these methods, and ships which have been fitted with this system in Sweden have shown a saving of 42 per cent. in coal, whilst the big battleships in the United States Navy have shown a saving with the sister ships of 30 per cent. and more.

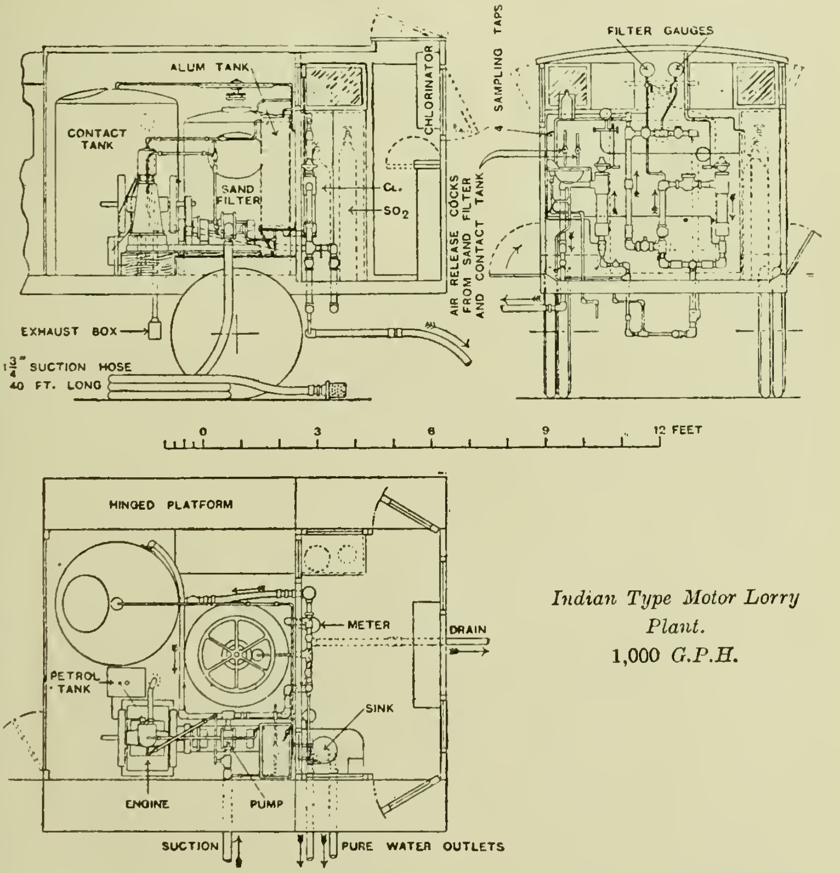
The main propeller driving motors can be placed right aft, bringing into play a short and efficient and reliable propeller shaft, not so liable to complete breakdown at sea in rough weather. A reduction of the vibration which is felt in nearly all vessels at sea is possible, and also a much better trim. The system reduces the number, size, and space occupied by the boiler plant; it requires condensers of a much smaller capacity and condensing surface, thus providing a greater volume for either passengers or cargo; and it brings about better conditions for the operating staff, with less trouble and labour. There is a great saving in weight and cost of plant, a saving in time of installation, or dismantling, and it increases the travelling radius per given bunker capacity to a great extent, bringing in its train the cheaper operation of ships at sea, and also in port, making a quicker turn-round possible and more voyages per year, with the same staff and with reduced fuel and capital costs, insurance, etc.

Captain Durtnall outlined the Paragon internal combustion engine operated with gas made from liquid fuel at high pressure. With these engines he claimed to have cleared away the complication of the reversible high-speed internal combustion engines. Such a plant would be ideal for naval vessels or for a 30-knot liner with a less displacement and draught than with either geared turbines or Diesel-engined vessels.

Reference was made to the activities of the United States Navy in regard to electric propulsion. They were, he said, aiming to produce a 36-knot cruiser, having 189,000 turbine horse power. The battle-cruisers *Ranger* and *Constellation* will each have an equipment of four turbine-alternators, each of 49,750 horse power, with steam pressure of 265 lbs. per sq. in., 50 deg. Fah. superheat, and 28½ in. vacuum, being equal to 40,000 k.v.a. of electrical energy, at 5,000 volts pressure, and at 51 to 53 cycles per second, while each vessel will have four shafts driving eight wound rotor induction motors—two on each propeller shaft—which are rated at 22,500 shaft horse power.

STERILISATION OF WATER BY CHLORINE GAS.

The aim of all water purification for drinking purposes is to produce a clear, tasteless water, free from harmful bacteria. The very best methods of filtration can only bring about a reduction of 98 per cent. of the total number of bacteria present in the water. In order to remove the remaining 2 per cent. of bacteria, and thus render the water perfectly safe, a process of sterilisation must be carried out. This process also acts as a safeguard in case of a breakdown of a sand-filter.



Indian Type Motor Lorry Plant.
1,000 *G.P.H.*

Many methods have been devised to carry out the complete sterilisation of water, and they can be divided into physical and chemical methods. The latter are cheap and comparatively easy to manipulate. They were employed by the British Army in France and elsewhere during the war, chiefly in portable plants on motor lorries, and during the war there was no water-borne disease in such territory. The methods are well adapted for use in the Far East, as they are equally applicable for land or water-borne plants or for large stationary installations. The following particulars of the processes involved are therefore taken from a paper on the subject recently read before the Institution of Mechanical Engineers by Captain J. Stanley Arthur, O.B.E., B.Sc.

Chlorine, either as the free element or combined, as in bleaching powder, is the chemical which is most largely used. Chlorine, in the gaseous condition, although used in America to a small extent for some time, has only come into general use during the last few years. The amount of chlorine, either as a gas or from bleaching powder, required to sterilise water is quite small. For a sedimented and filtered water less than half a part of chlorine per million parts of water is sufficient for complete sterilisation, and for a crude water only three to four parts per million are required, provided that this chemical is allowed to remain in contact with the water under treatment for not less than twenty minutes.

The first advance was the production of a type of water purification plant which sterilised water by a continuous process at the rate of 125 gallons per hour, using bleaching powder as the sterilising chemical. A larger plant was then devised in which the excess of chlorine that was left in the water after sterilisation was completed, was removed by means of a solution of sodium bisulphite. Defects in this type were overcome by the introduction of the use of chlorine gas, and a new type of water purification plant was devised which has been adopted with minor alterations to meet special conditions, as the standard of the British Army.

In 1912 a patent was granted to Major Darnell, of the American Army, for an apparatus for the administration of chlorine gas to water for the purpose of sterilising it. But the chlorinating apparatus which has proved commercially successful is that made by Messrs. Wallace and Tiernan, of New York, who, working upon the lines of the Darnell apparatus, have produced two types of chlorinators which have proved very successful in operation.

The two types of apparatus manufactured by Wallace and Tiernan are the same in principle, but differ in that, in the direct-feed type, chlorine gas is added directly to the water under treatment, while in the solution-feed type the gas is first dissolved in water and this solution added. Both types have as an object the delivery of a continuous supply of chlorine to water at a known indicated uniform rate, which is independent of any changes of pressure of the chlorine in the containing cylinder. The first instrument—a direct-feed type—was brought to England in August, 1916, and placed at the disposal of the War Office by Messrs. United Water Softeners, Ltd. During the tests made it was suggested that the use of sulphur dioxide gas to remove the excess of chlorine left in the water after completion of sterilisation would render the process more efficient in that the purified water would be free from the slight taste imparted to it by chlorine, and would render the removal of this taste much easier than would the use of a solution of sodium bisulphite. This method has been adopted as standard for all types of water purification plants in the Army, except very small ones which are too small to allow of this process to be economically used.

The Wallace and Tiernan chlorinater is actually a reducing valve and meter combined, and consists of three main portions:—

(1) The compensator, in which alterations of pressure in the cylinder are compensated.

(2) The metering or flow-measuring apparatus combined in the orifice, scale and manometer.

(3 The check-valve—or back-pressure valve—and diffusor.

By means of the apparatus the chlorine enters the compensator at any pressure, and, after passing through it to the orifice, it is metered and leaves the apparatus at a constant pressure, and is forced into the water through the diffusor, which breaks up the gas into very small bubbles. The amount of chlorine passing through the apparatus is regulated by means of the control-valve, and when once set will continue to deliver chlorine at the set rate until the cylinder is empty. For a temporary stoppage, it is only necessary to close the auxiliary tank-valve, and on restarting to open this valve. The apparatus can be emptied of chlorine by means of the blow-off valve.

It is necessary that moisture should be kept from getting inside the apparatus, as although dry chlorine has no effect, moist chlorine will rapidly corrode the metal parts of the apparatus. It is also necessary to keep the cylinder of chlorine at about the same temperature as the chlorinator as, at low temperatures, chlorine under pressure very easily liquefies, and if the instrument is colder than the cylinder liquid chlorine will collect in it and render the flow of chlorine unsteady.

The solution-feed type of apparatus differs from the direct-feed type in that the chlorine, after it passes from the compensator, passes to a bubble meter in which the bubbles of chlorine are seen and counted and are dissolved in water. The rate of flow of the chlorine is determined by the rate of the bubbles and regulated by means of the control-valve on the compensator. After the bubbles of chlorine have dissolved in the water that is led to the bubble meter and which is under constant agitation, it is injected into the water that has to be sterilised. This type of instrument has the advantage over the direct-feed type in that the actual chlorine that is being used is seen, and that it can be used to deliver smaller amounts of chlorine. It is, however, slightly more complicated, and requires more care in fitting up, but it is, if anything, more accurate than the direct feed.

The process of purification may be divided into five main operations:—

(1) Coagulation of suspended matter by means of aluminium sulphate solution, or, if necessary, with this chemical and an alkali.

(2) Sedimentation of the water as treated.

(3) Filtration of the water after coagulation and sedimentation.

(4) Sterilisation, using chlorine gas.

(5) Dechlorination, using sulphur dioxide gas.

Under some circumstances it may not be necessary to chemically treat or sediment the water before filtration, but whenever the crude water contains a large amount of fine material in suspension, or is coloured by iron or clays, a preliminary chemical treatment is essential.

Coagulation and sedimentation are carried out by the motor portable plants in canvas dams, but in other plants pre-treatment tanks for part of the plants. If it is necessary to pre-treat the water, the required amount of aluminium sulphate, or alum, together with lime or soda if the water is very soft, is added to the water and well mixed. After standing for some time the water clears, and the suspended matter falls to the bottom with the aluminium hydroxide which has been formed by the hydrolysis of the aluminium sulphate. The cleared water is then led to the filters in such a way that the sediment in the pre-treatment tanks remains undisturbed.

Filtration always takes place through the sand from the top downwards. The object of the mechanical stirring arrangement employed and the arrangement for sending the water up through the sand is to enable this to be backflushed or cleansed after it has been in use for some time, thus removing the matter which has been filtered out on the top of the sand, and which gradually causes the filtration pressure to increase.

In the Ransome filter, recently described in these pages, used on some large and stationary plants, a modification of the ordinary filter is used, a mechanical stirring arrangement being unnecessary, as the surface of the sand is constantly shifting and being replaced by sand which has been automatically washed.

After filtration the water is sterilised, and complete sterilisation takes place after the water has been in contact with chlorine for not less than twenty minutes. Tho water, although filtered and free from bacteria, contains some chlorine, and as a consequence has a slight taste. This taste can be completely removed by the addition of sulphur dioxide, the chlorine reacting with this gas to produce hydrochloric and sulphuric acids, or chlorides and sulphates, which, at the very great dilution at which they are present, cannot be detected by taste.

For very small plants, and those which are not in frequent use, the initial cost of a chlorine-sulphur dioxide installation is comparatively high, and for this reason chlorine will never replace entirely chloride of lime as a sterilising chemical for water. Chloride of lime, however, has one very serious disadvantage in that it is very easily decomposed by even a moderate temperature. As a result of experiments undertaken with the object of producing a sterilising chemical which was not easily decomposed by heat a new substance has been introduced. This chemical is known as bromine bleaching powder, and is very similar in properties to chlorine bleaching powder, except that it is not decomposed at temperatures as high as 100 deg. C. Bromine bleaching powder imparts a less objectionable taste to water than ordinary bleaching powder, and is quite an efficient sterilising chemical.

From this survey it is evident that a supply of sterilised water can be maintained under almost any possible conditions by the use of one or other of the various types of water purification plants mentioned. The diagrams accompanying this article show new portable plants ordered for the East, which are specially light and compact.

* * *

The Dutch Government has placed an order with the Norddeutsche See Kabelwerke for from 1,500 to 2,000 sea miles of cable, destined to establish telegraphic communication among the islands of the Dutch East Indies. The gutta-percha used in the manufacture of the cables comes principally from the Dutch colonies. The two cable ships formerly used by Germany have, by the terms of the Peace Treaty, been delivered to the Allies. One is in the possession of England and the other of Italy. They will be definitely disposed of at the International Communications Conference at present being held at Washington. In the circumstances the cables will be laid by a large German freight boat, converted for the purpose into a cable ship, and which will proceed to the Dutch East Indies at the beginning of next year.

DEVELOPMENTS AND PROSPECTS IN THE ABACA INDUSTRY.

The abaca or Manila hemp industry is virtually a monopoly of the Philippines. The number of plants of this island group which yield fibre for the various purposes of the natives is large, but only two—abaca and maguey—are at present of notable commercial importance for rope and bag manufacture, and of these abaca easily takes the first place. The abaca plant, *Musa textilis*, is closely related to the banana, and has therefore no affinity with true hemp (*Cannabis sativa*). As many as fourteen varieties are under cultivation in the islands—principally in the central and southern parts, and with most success in south-eastern Luzon, Samar, and Leyte. Suitable varieties may be grown up to 3,000 feet. With favourable conditions of climate and exposure it does best on alluvial plains subject to the overflow of rivers, and the moist loams formed by the disintegration of volcanic rock. Relatively high humidity is desirable, and shelter from heavy winds. Its culture consists of cleaning the ground and keeping it loose and free from weeds, and the provision of suitable shade. The first stalks are ready for harvesting from twenty months to three years after planting. The fibre is yielded from the outer part of the leaf-sheaths which envelop the stem, and the process of extraction by hand consists, firstly, in the removal of the strips of fibrous material from the leaf-sheath, and secondly, in the separation of the fibres by pulling the ribbons under a knife, the quality depending upon the form and condition of the knife-blade and the pressure exerted. Between 1900 and 1914 the industry was in an unsatisfactory condition, but an Act passed in 1914 has done much to remedy abuses by establishing standard grades for the chief commercial fibres and providing over 100 grading establishments.

The exports of abaca have risen from 70,000 long tons in 1899 to nearly 170,000 in 1917 (175,000 in 1912), and the value in a still higher ratio, though owing to the development of the copra and sugar industries the proportion to total exports has fallen from about two-thirds to one-half. The bulk of the trade is with the United States, England, Japan, France, and Switzerland. The future of the maguey industry (used almost entirely for binder twine) also promises well. The export, begun in 1904, reached a total of over 15,000 tons in 1916.

ABACA WASTE FOR PAPER MAKING.

Proposals have been made for developing the industry through new uses of abaca and other fibres, particularly for paper-making, for which the employment of the entire abaca plant is recommended. It will be interesting to summarise the prospects held out in that direction. Extensive use can without doubt be made of abaca or Manila hemp waste in the manufacture of certain classes of paper. The term abaca waste signifies that portion of the fibre that is missed or thrown aside with the stalk pulp at the time of and in the process of stripping the fibre or extracting it from the plant. From this process two kinds of waste material are obtained, both of which are of value in paper making. One of these is called fibrous waste and the other semi-fibrous waste. The former is made up of the broken, tangled or lost, but clean, fibres mixed with strips or bands of fibre aggregates from which the cellular and incrusting matter has not been entirely removed. The fibre contained in this waste has all the qualites of the fibre that is recovered by the stripper and subsequently employed in the manufacture of cordage. It is, therefore, identical with the fibre contained in rope waste, well known among the manufacturers of paper. There is this difference, however, this fibre is fresh, and has not suffered the deterioration of age. Naturally the same process employed in the manufacture of paper and paper pulp from waste abaca (hemp) rope is applicable to their manufacture from the fibrous waste that results from the stripping or extraction of abaca fibre. The semi-fibrous waste might readily be manufactured into wrapping paper of the sort in which strength and cheapness are of more importance than colour, by the process that is employed in working up jute, that is, by the use of lime, cooking under pressure and partial bleaching.

TREATMENT OF FIBROUS ABACA WASTE

The best grades of fibrous abaca waste yield about 50 per cent. of strong-fibred stock, when developed by sulphite digestions. For the best results it is important that the waste be as clean and free from extraneous matter as it is possible to make it by mechanical cleaning. It has been found advantageous to moisten the material either by a preliminary steaming or by the use of cold water, so that it might be readily compressed into smaller bulk than in the dry state and require a smaller amount of the digesting liquor to cover it. Contrary to the practice required in dense wood, the gradual increase in temperature is not required in digesting abaca waste. The porous nature of the material makes it possible to heat the digester to the maximum temperature at once, and so save considerable time in the process of digestion.

The stock obtained from the fibrous waste of abaca by the sulphite process is more easily washed than that obtained by the lime or soda process. When first taken from the washing engines its colour is found to be as light as the partially bleached stock obtained from this material by lime or soda. This fact is regarded as of special importance because of the saving made in the cost of bleaching and because of the susceptibility to chlorination and the consequent impairment of the resulting pulp in the process of bleaching.

It is believed that the saving in freight made by pulping the waste near the place where it is produced would amount to fully 50 per cent. It is also estimated that the cost of installation and operation of a hydraulic baling press would nearly offset the cost and operation of a pulp mill of a capacity of 10 tons daily. This abaca waste, as it reached the factory, would need to be thoroughly dusted, and either picked over by hand or sorted by machinery, as is done with dirty rags and waste rope. The supply of this material for a mill in the Philippines would be practically limitless, and there is leading authority for stating that abaca fibre is the strongest fibre known to paper makers.

MODERN ENGINEERING PRACTICE.

ELECTRICALLY-HARDENED TAPS.

Tests of taps hardened in electric and gas furnaces respectively made at the Frankford (Pa.) Arsenal, U.S.A., show that superior physical qualities, as shown by longer life, are obtained with the electrical treatment. The electric furnace was, after brief instructions, operated by the same man who had hardened taps in the gas furnace for several years. The taps were used for tapping fuse holes in steel projectiles, and tests were made on taps from four different brands of steel. The outer case of the taps should be the hardest, and if the tap is held to shape in hardening, more of its hard surface remains for use. This would probably be the case in the electric furnace and might account for the greater life before the first regrind. Then, again, there is more decarbonisation in the gas furnace, and this would cause the surface to be composed of low-carbon steel, which would not be good for cutting purposes. In the electric furnace the work is heated in a neutral atmosphere and emerges virtually as clean after hardening as before it was placed in the furnace, saving considerable time and money for finishing. The electrical treatment given the dies makes use of a recording thermocouple which indicates by a "hump" in the temperature curve that the critical point in the heating of the metal has been reached. The hump corresponds to a pause in the temperature rise, in spite of the fact that heat is being steadily transferred to the work. It is said to be an accurate means for determining the exact amount of heating that should be applied to the material under treatment. Statistics of the tests were published in the *Electrical World*, from which these particulars are taken.

WARM-AIR FURNACE INVESTIGATION.

This investigation is in progress at the University of Illinois. It has for its object the determination of the efficiencies and capacities of warm-air furnaces and a study of the proper conditions of installation and operation. Results are now to hand of tests of the emissivity of heat from various surfaces, and these allow of the following significant conclusions which should be adopted in standard practice :—

(1) The use of thin sheets of asbestos paper on bright tin heat pipes results in a waste of heat. The use should be abandoned.

(2) Uncovered bright tin pipes are more efficient carriers of heated air than asbestos paper-covered bright tin pipes. See item (4).

(3) This fact is true regardless of the degree of brightness of the tin surface.

(4) No small number of applications of asbestos paper will suffice as an insulator. Several thicknesses are necessary to make a covering equal in this respect to the bare tin.

(5) The accumulation of dust and dirt on the pipes does not greatly alter the amount of the loss.

(6) The heat loss from warm-air furnace pipes covered with one layer of asbestos paper is a serious item in the cost of heating, amounting to more than 5 per cent. of the coal consumption, depending upon the number and size of the pipes used.

(7) The fact that pipes are partly protected from convection currents of air by joists and studding does not greatly affect the loss.

(8) Unless the insulation excels the uncovered bright tin in heat insulation properties it should not be used.

(9) Such materials are available, and the tests have shown their merits.

IMPROVED TYPE OF SWITCHGEAR.

Modern practice in embodying safety devices in H.T. and E. H. T. switchgear was well illustrated by certain exhibits at the Shipbuilding, Engineering and Electrical Exhibition just held at Glasgow. As a case in point mention may be made of the E.H.T. truck-type cubicle up to 660 amperes, 11,000 of Messrs. Ferguson, Pailin, Ltd. The truck cannot be withdrawn until the oil switch is " off," neither can the truck be replaced with the oil switch " on." When the truck is withdrawn, shutters automatically close over the holes through which the plugs have passed, so that the whole of the live metal work is protected. As the carriage is wheeled in, the shutters are automatically raised to allow the plug insulators to pass. This is an important feature, as the switchboard can be left with any of the trucks withdrawn and no high-tension metal exposed. The plug contacts are self-aligning, the plugs being circular in section and having a free movement in both directions, so that they can adjust themselves to make perfect contact in the sockets, even though the carriage may be slightly out of alignment. Practically no movement is required, as the runways for the carriage are part of the side frames and are not dependent on the station floor, which may be uneven. The carriage wheels are fitted with roller bearings so as to provide ease of movement. The oil switch has a heavy breaking capacity and is provided with separate tanks for each phase. The switch used has been standardised by two large electric supply authorities, each of which have generating plant exceeding 50,000 kw. The structure may be erected against the wall so as to economise in space, and the design allows of easy extension—any number of panels may be added from time to time.

HOW TO USE A HACK-SAW.

A deal of skill is required in the use of a hack-saw—that is if saw breakage is to be avoided. In the first place the saw requires to be set quite firmly in its frame, given a fair amount of tension, and so held that twisting is prevented. In its use it must be remembered that the teeth are given a certain amount of rake or inclination in order to cut one way only, that is, in a forward direction. Therefore cutting pressure should be applied only on the forward stroke, the saw being eased slightly out of the cut on each return stroke. As a rule, says *Canadian Machinery*, a hack-saw frame is so arranged that the saw can be fixed in four positions, this being often a great convenience. Always use the full length of the blade if it is at all possible, the general inclination among workers being to devote all their energies to the middle three or four inches; hence a saw is often scrapped as worn out when only about half its length is unfit for further service, the other half being practically as good as ever. When putting a new saw to work on hard metal, tool steel, or the like, use very little downward pressure, otherwise the danger of ripping off three or four consecutive teeth, and so utterly spoiling the saw, is always present. Use a dry saw for cast iron, brass, or gun metal, but slightly grease it when sawing mild steel. When a saw chokes, withdraw it from the cut and rub it downwards with the finger and thumb pressed tightly against the teeth. Present-day hack-saws are invariably too hard to be re-sharpened when becoming dull, and it is questionable if it would be a paying policy to do so were it possible.

THORNYCROFT'S ACTIVITIES AT SOUTHAMPTON.

Messrs. John I. Thornycroft & Co., Ltd., recently launched at their Woolston Shipyard, Southampton, their third cargo steamer within the past few weeks. This was the s.s. *Ville de Dannemarie*, building to the order of Messieurs Le Groupement Industriel de Charbons et de Transports, Rouen, France.

The *Ville de Dannemarie*, which was designed by her builders, is of the firm's standard well deck with raised quarter-deck type. Her principal dimensions are:—Length (b.p), 240 ft.; breadth (moulded), 36 ft.; depth (moulded), 18 ft. 6 in.; draught, 16 ft. 9 in.; and her tonnage (d.w.) about 2,000. She is built of mild steel to Lloyd's requirements for a 100 A1 class cargo steamer. The vessel's two cargo holds, one forward and the other aft, contain a combined capacity of 90,000 cu. ft., while coal bunkers for 150 tons are also provided. Water ballast is carried in the cellular double bottom and in fore and aft peak tanks.

The propelling machinery, constructed in Messrs. Thorny-

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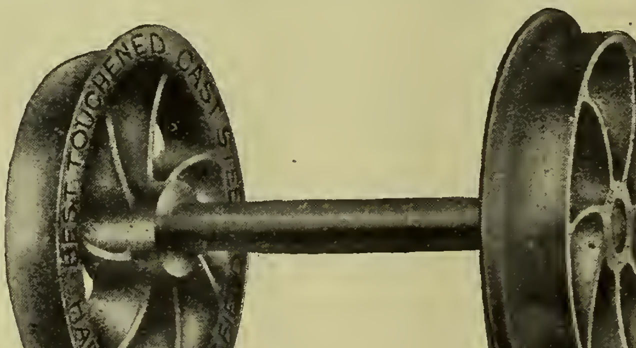

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croft's Engine Works, consists of triple expansion engines having cylinders 18 in. by 30 in. by 50 in. diameter by 33 in. stroke, developing 900 i.h.p., and giving the ship's speed of 9½ to 10 knots. Steam is generated in two Scotch boilers, each having two furnaces. These boilers are each 10 ft. 6 in. in length, 13 ft. 2 in. in diameter, and provide a working pressure of 180 lb. per sq. in. The 7½ in circulating pump is supplied by Messrs. Drysdale; the general service pump and the auxiliary feed pump, each 6½ in. by 4½ in. by 6 in., supplied by Messrs. Carruthers, are of the duplex type; while the Mumford duplex ballast pump is 8 in. by 9 in. by 8 in. The cargo handling equipment consists of four 7 in. by 10 in. steam winches by Messrs. Rogers, two are placed in the forward part of ship and two aft. Four large cargo hatches, equipped with eight 3½-ton derricks of pitch pine, facilitate the rapid handling of the coal or general cargo which the ship is destined to carry.

SHIP COMPENDIUM AND YEAR-BOOK.

Our attention has been drawn to the publication early next year by Compendiums, Ltd., of 18, Old Compton Street, London, W., of *The Ship Compendium and Year-Book*. The publishers state that this will be a work of international importance of upwards of 1,000 pages, and containing, at the time of going to press, complete lists of the shipbuilders, shipowners, marine engineers, ports, harbours, dockyards, coaling stations, fuel oil stations, cable and wireless stations, naval architects, naval colleges, nautical academies and institutions, banks and bankers, dock and harbour commissioners, boards of trade, admiralties and their officials, ministries and boards of shipping, ministries of transport, shipbrokers, flags and funnels of the mercantile marine, technical and professional societies, benevolent institutions, salvage associations and shipping registries throughout the world. Tonnage and constructional statistics, the year's losses, ship and shipping law, insurance and indemnity, the British Admiralty, and many other subjects connected with the shipping world will be fully covered. Even victualling stores in the different ports of the world will be included. The publishers claim that nothing of importance connected with shipping will be omitted, and that the work will be a complete referendum of the world's shipping interests, arranged and classified alphabetically and geographically.

NEW STEAMER BY J. SAMUEL WHITE AND CO., LTD.

Many indications reach us that in Great Britain the South Coast is once again resuming its former status as a shipbuilding centre. In this connection interest attaches to the particulars sent us by Messrs. J. Samuel White, Ltd., of East Cowes, Isle of Wight, of their latest vessel, s.s. *River Tees*. This ship is of the raised quarter-deck type, wtih machinery aft, full forecastle and bridge house, and has the following dimensions: Length overall, 187 ft.; length b.p., 180 ft.; breadth, 29 ft. 3 in.; moulded depth, 13 ft. 6 in.; deadweight, 925 tons; and is built of mild steel to Lloyd's requirements for 100 A1 class. The cargo-handling equipment consists of three double 7 in. by 12 in. steam winches by Messrs. Clarke, Chapman & Co., and three 4-ton derricks. The machinery, which has been constructed and fitted by the builders, consists of a set of triple-expansion engines having cylinders 15 in., 25½ in., and 41 in. diameter by 30 in. stroke, the usual auxiliaries being fitted. Steam is supplied by a marine-type return tube boiler 10 ft. 9 in. in length by 15 ft. diameter, working at 180 lb. pressure. Throughout the trial everything worked satisfactorily, the speed attained being 10½ knots.

WIRE NETTING AS A SAFEGUARD AGAINST PILFERAGE DURING TRANSIT.

The Shipping Department of the Federation of British Industries has recently had its attention drawn by the South African Steam Conference to a method of packing which has been used with good results, and is recommended to producers consigning goods or produce liable to pilferage.

The method adopted is that of packing piece and other goods in wire netting, these then being made into cases or bales as usual with hoop iron bands on the outside. Where such packing is used it would appear that before any article could be extracted the parcel would have to be entirely opened up, thus causing delay and consequent greater liability to detection. It is considered that the small extra cost involved would be well spent if it increased the difficulty of removing quickly the particular article desired in any package.

The continued and increasing losses incurred by pilferage

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UNITED BRASSFOUNDERS AND ENGINEERS LTD.,
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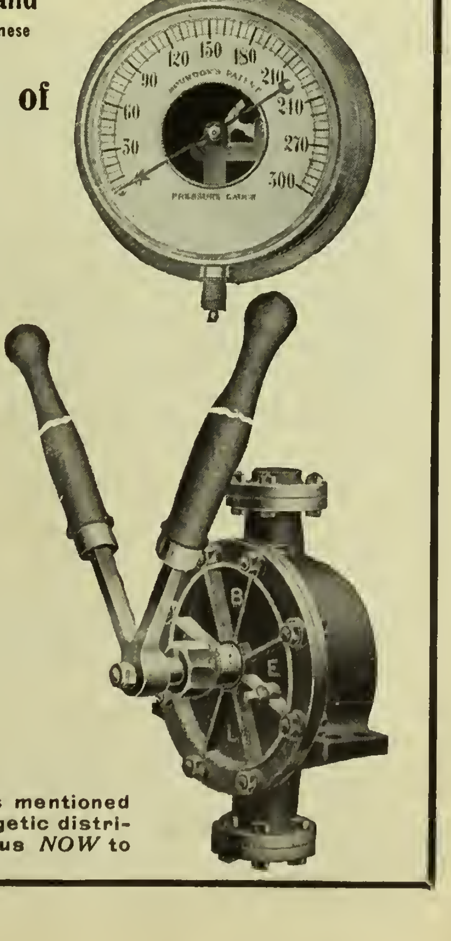

whether in transit to or from railway station, or quay side or on board ship, have for some time past been engaging the serious atention of all bodies interested, and various suggestions have been made with a view to counteracting the evil.

PERSONALIA.

THE death has taken place of Mr. Tom Frederick Fuller, for many years partner, with his brother, in the firm of John C. Fuller & Son, electrical engineers. Prior to joining his brother he was with the Electric Telegraph Co., the India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., of Silvertown, and W. T. Henley's Telegraph Works Co., Ltd.

MR. J. GORDON HARE, F.R.G.S., who has for some years been associated with Douglas & Grant, Ltd., of Kirkcaldy, in its Far Eastern and Overseas development generally, has now been appointed a director of the company. Mr. Hare is proceeding immediately on an extended visit to the firm's many Eastern and Far Eastern branches.

MR. T. M. AINSCOUGH, British Senior Trade Commissioner in India and Ceylon, and well known to industrial and commercial circles in the Far East, has completed his visit to Great Britain and left London on November 25, *en route* for Bombay.

MR. T. FURNESS and Mr. J. E. James (general works manager) have been elected directors of the Cargo-Fleet Iron Co., Ltd., Middlesbrough-on-Tees.

THE late Mr. B. W. Winder, a master of metallurgy in Sheffield University, and chairman of Jonas & Colver, Ltd., left estate valued at £70,218.

WE regret to record the death of Mr. J. Stubbs, a director of Elliotts Metal Co., of Birmingham, and other industrial concerns.

SINCE our last issue the death has been announced of Mr. T. B. Birkby, chairman of Fleming, Birkby & Goodall, Ltd.

THE late Mr. P. MacNab Inglis, late of J. & A. Inglis, Ltd., left personal estate valued at £171,163.

THE late Mr. W. Peech, of Steel, Peech & Tozer, Ltd., Sheffield, left £533,699.

TRADE NOTES.

JOHN I. THORNYCROFT & CO., LTD.—The accounts show dividends in respect of the year ended July 31 last of 3 per cent. on the preference shares, making 6 per cent. for the year; on the participating preferred ordinary (calculated from the due date of instalment less interim dividend paid on April 28 last of 5d. per share), 9 per cent., and on the ordinary shares 8 per cent., making 13 per cent. for the year. The sum of £35,000 is carried to reserve, leaving about £53,000 to carry forward. The total dividend on the ordinary shares in the previous year was 12½ per cent.

THE issue has been announced of £3,000,000 8 per cent. seven-year secured notes of Explosives Trades, Ltd., at the price of 96½ per cent. The company is an amalgamation of Nobel's Explosives Co., Ltd., Curtiss & Harvey, Ltd., Kynoch, Ltd., Eley Bros., Ltd. and numerous other companies manufacturing mining and industrial explosives, etc. The notes are specifically secured by shares of Nobel's Explosives Co., Ltd., valued at £6,623,000, the company undertaking to maintain the value of the security. Nobel's Explosives Co., Ltd., has no debenture debt.

THE accounts of the Cargo Fleet Iron Co., Ltd., of Middlesbrough-on-Tees, show:—Dividend for 1920, 5 per cent., less tax. Reports for 1918 and 1919:—Balance of profit at September 30, 1918, £222,665; ordinary dividend, 5 per cent., £50,000; depreciation, £75,000; general reserve, £50,000; carried forward, £47,665 14s. 5d.; profits for 1919, £215,940; debenture interest, £43,148 4s. 11d.; disposable balance, £220,458; dividend, 5 per cent. (less tax), £50,000; depreciation, £75,000; reserve, £50,000; carry forward, £45,458.

WILLIAM BEARDMORE & CO., LTD., have issued £1,000,000 8 per cent. seven-year notes at 97½ per cent. These notes will be repayable at par on January 1, 1928, subject to the right reserved by the company to redeem them at par at any time after December 31, 1923, subject to three months' notice terminating on any interest date. The proceeds are required to provide further working capital and for the company's general purposes.

EBBW VALE STEEL, IRON & COAL CO., LTD., have paid an interim preference dividend, 7 per cent. per annum for the half-year. The company has just issued £1,506,000 8 per cent. seven-year notes at 98½ per cent.

FOR THE PLANTATION, MINE OR WORKS

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The Electric Loco shown will haul or push loads up to 10 tons on any gauge track 19 in. to Standard 4 ft. 8½ in. Simple, safe and cheap to use. A boy can drive it. Apply the brake the Loco stops, and cannot be started again till the brake is released. Built of Steel and Iron the Loco is indestructible.

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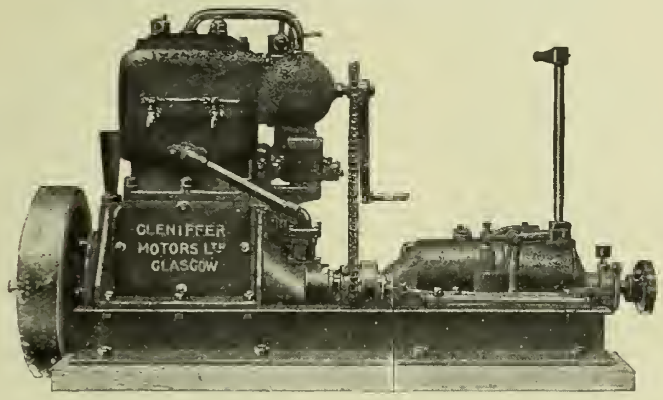

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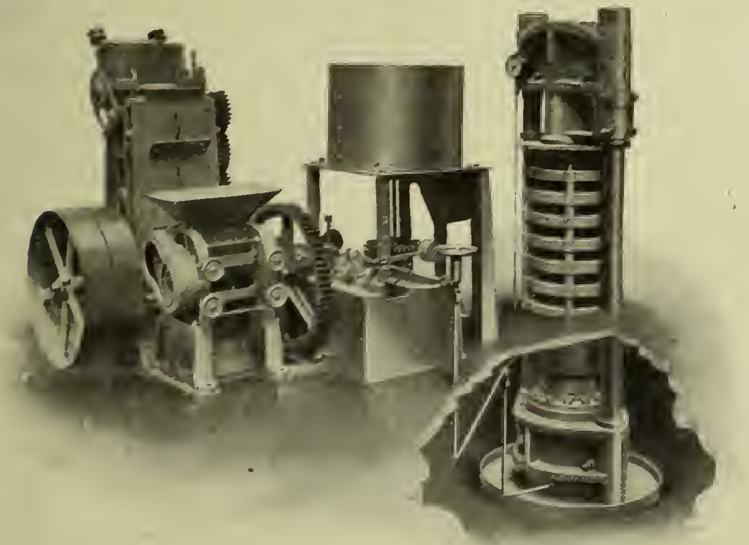

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DIMENSIONS—2 ft. 6 in. by 3 ft. 9 in. by 5 ft. 10 in. high.
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This Condenser improves the Power Factor of a 300 k.W. load from ·6 to ·9, and reduces the apparent load from 500 to 333 k.V.A.

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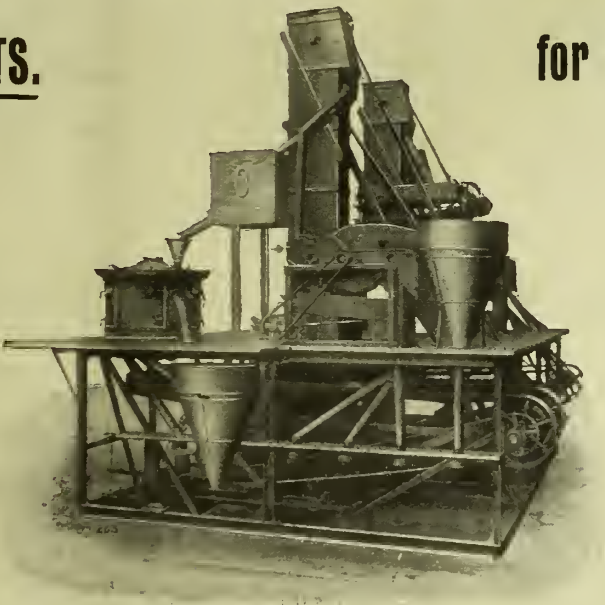
for **ALL OUTPUTS.** for **ALL COUNTRIES.**



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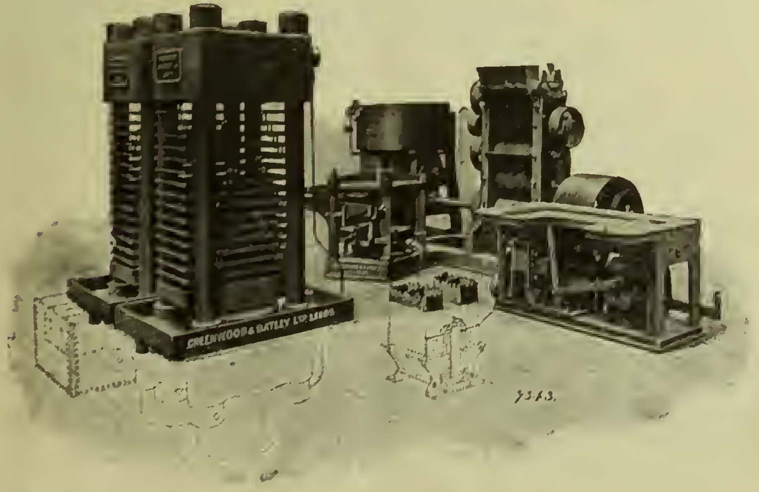

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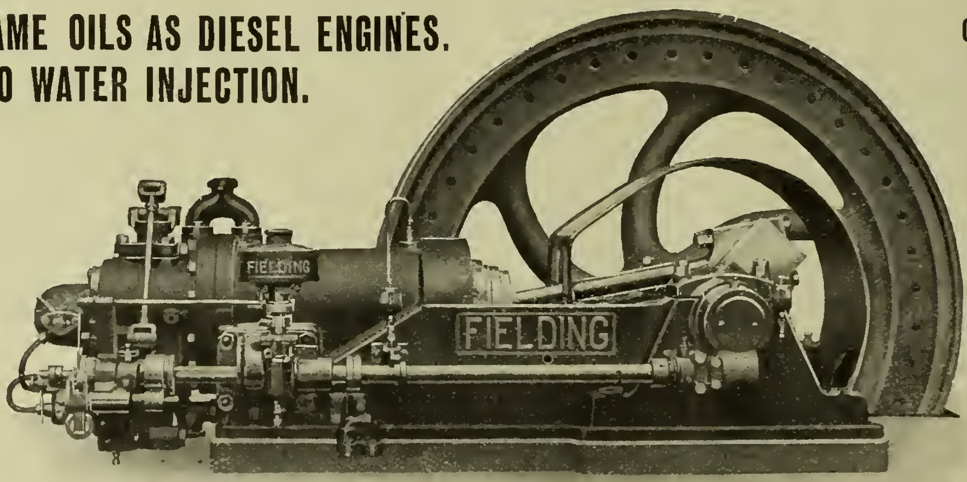

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34 **EVERSHED & VIGNOLES, LTD.,** Acton Lane Works, Chiswick, London, England.	電學儀器；"梅格""橋梅格"與"笪克頭"試驗全套，能量各種阻力. 34	愛弗夕與月格羅士有限公司倫敦
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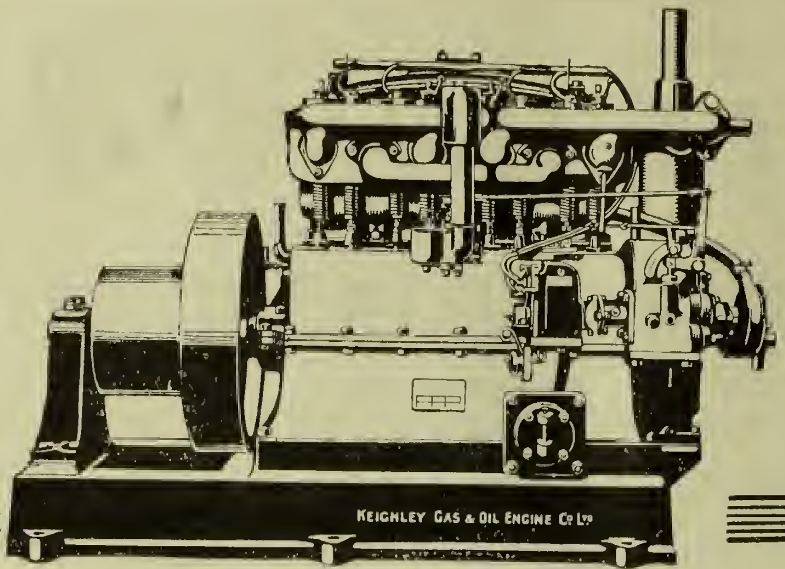
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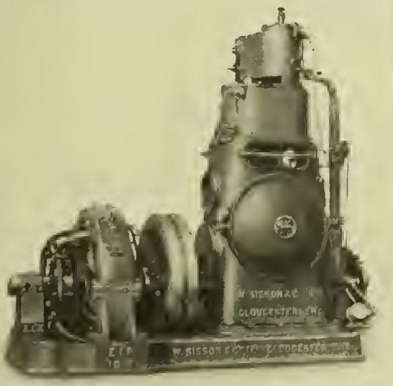

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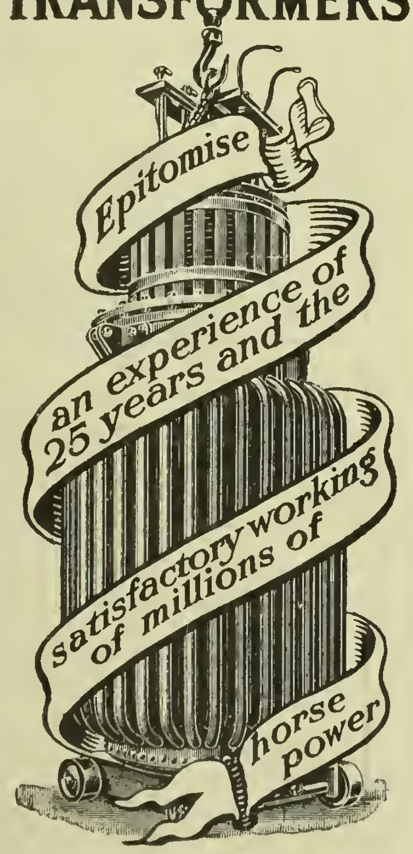

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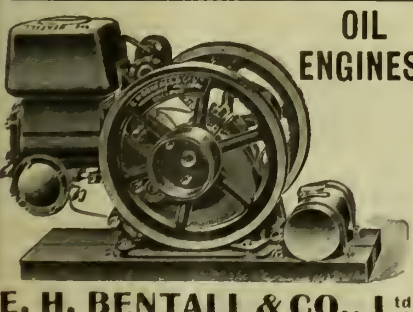

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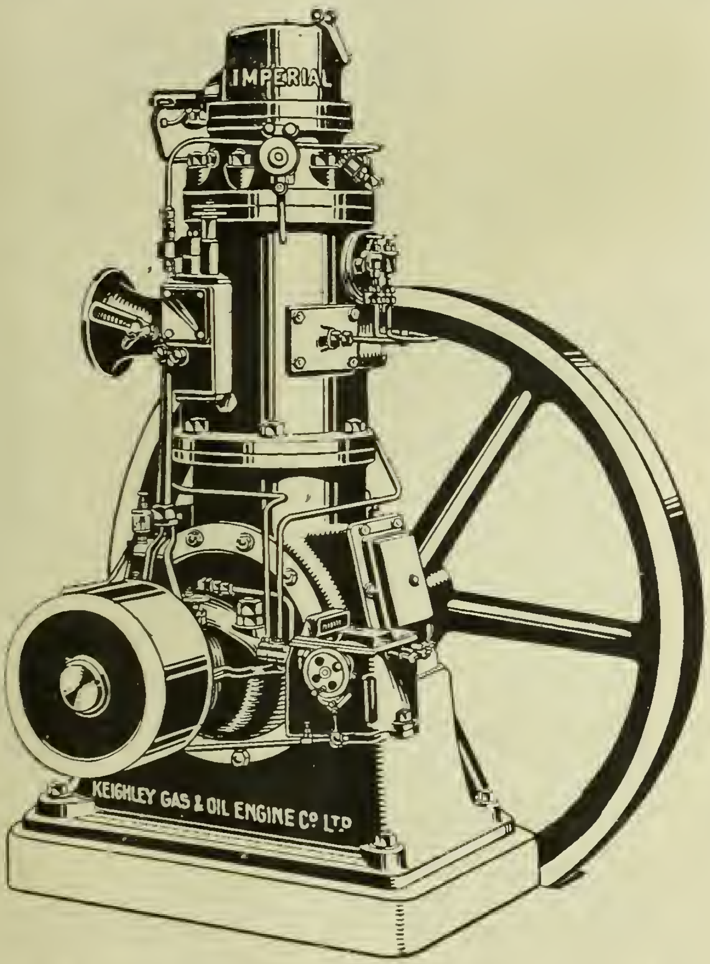
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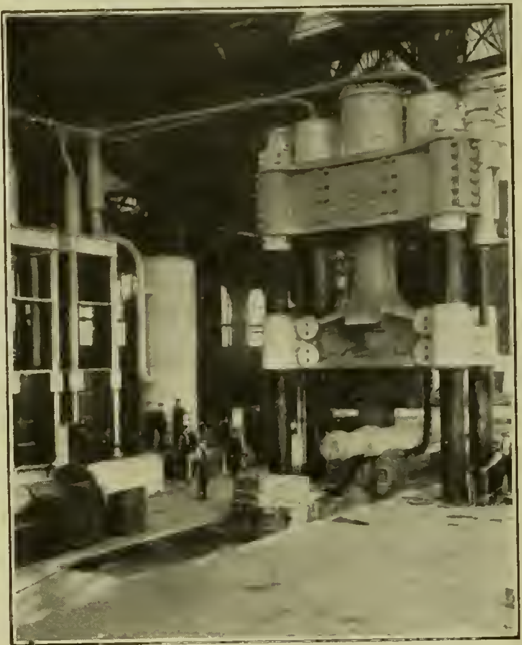

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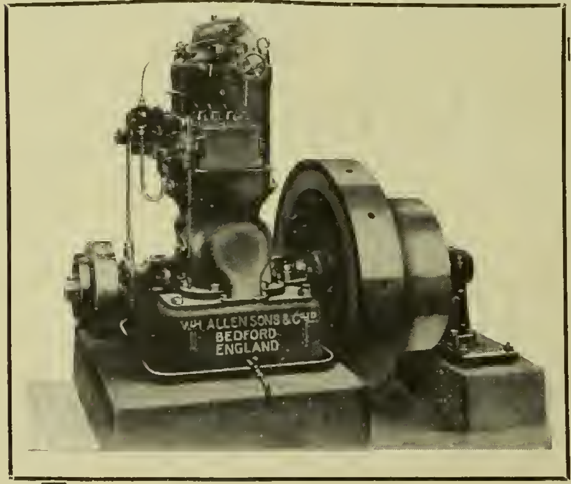

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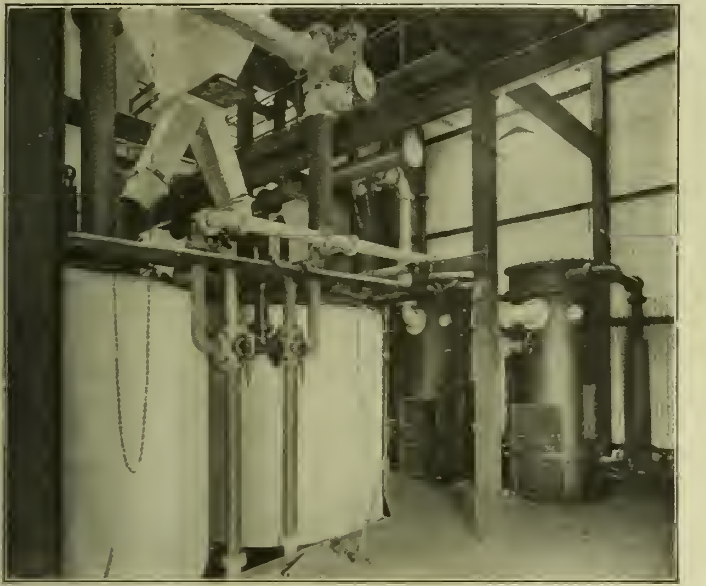

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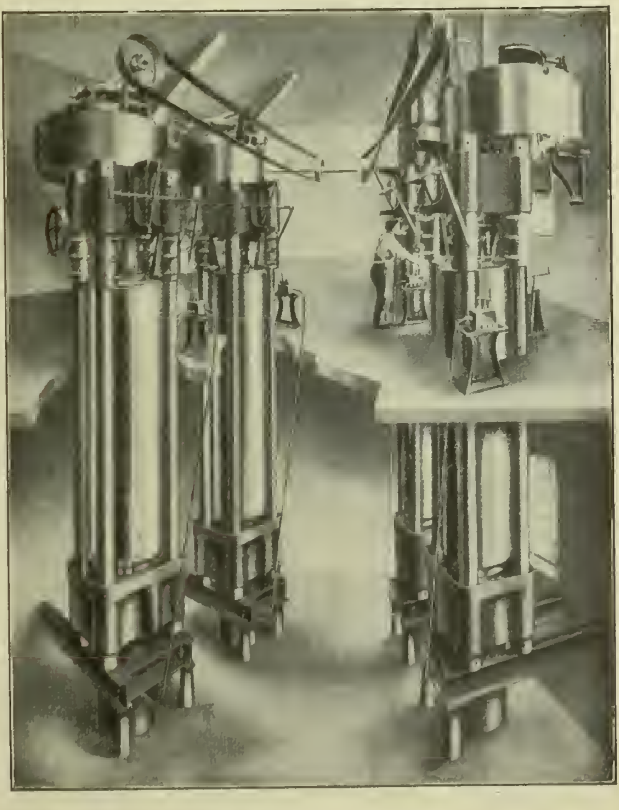

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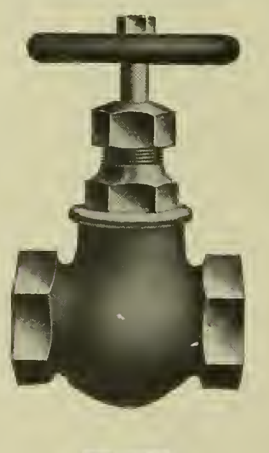

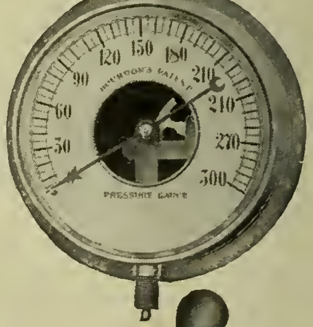

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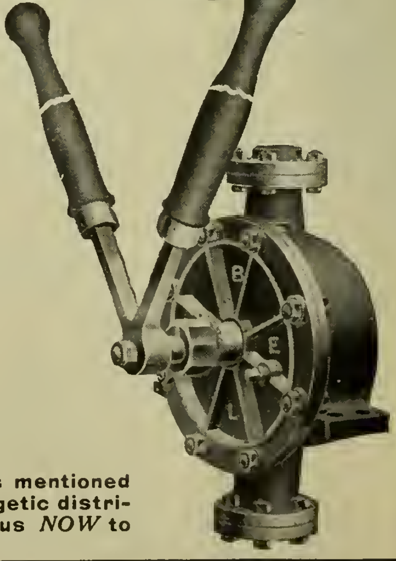

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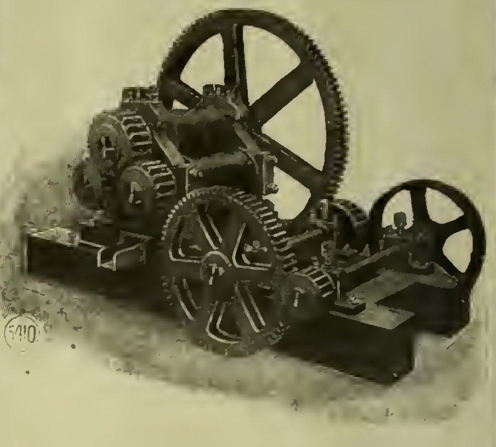

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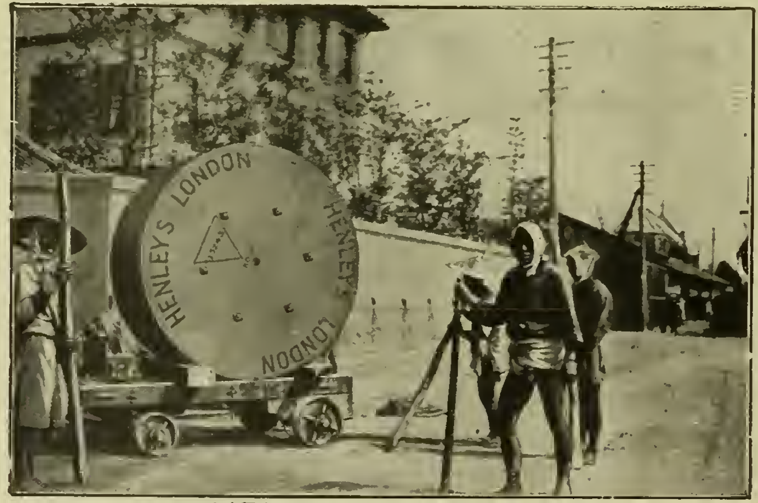

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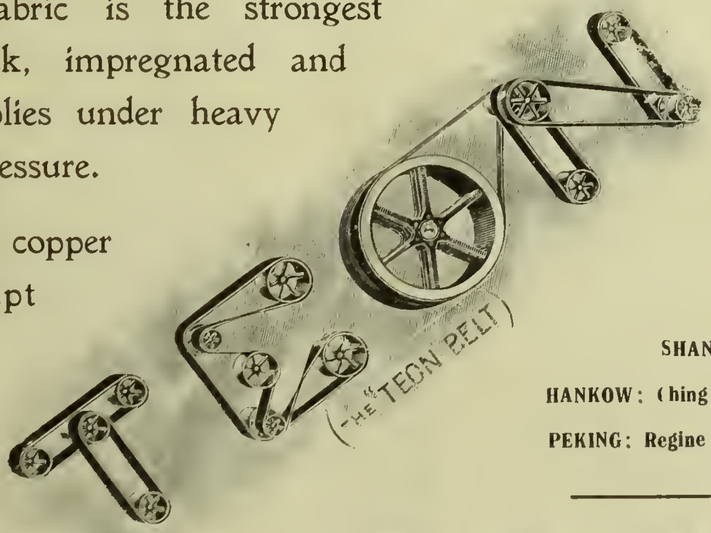

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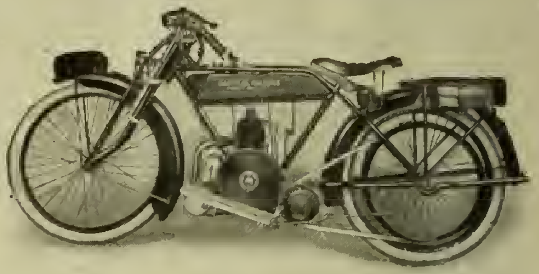

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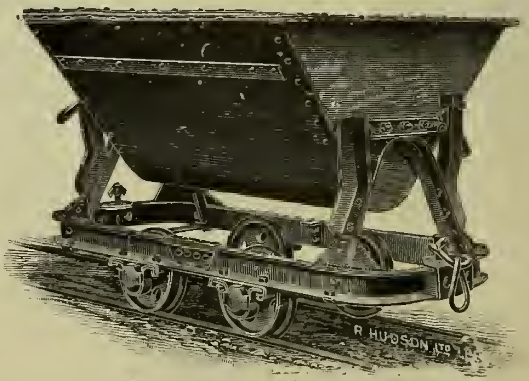

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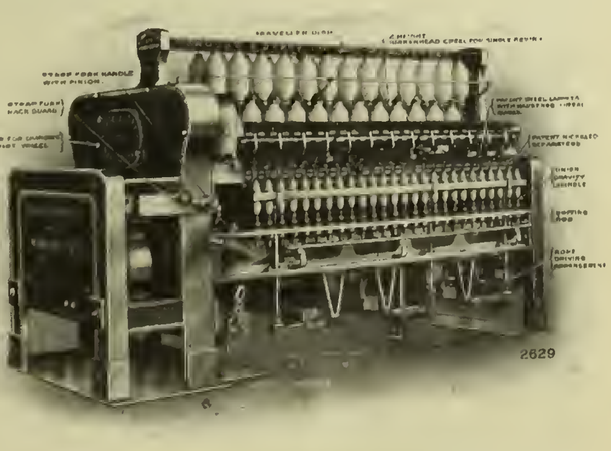

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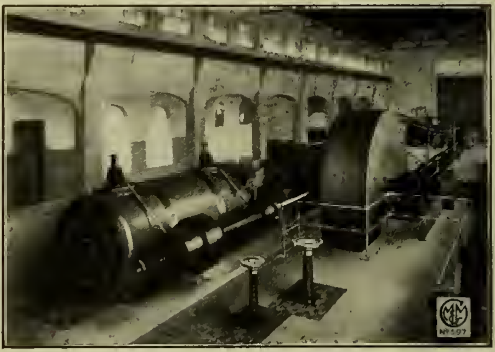

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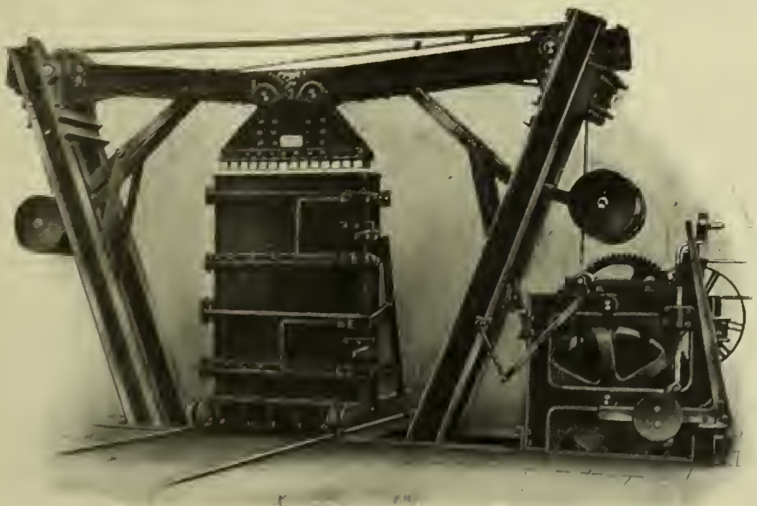

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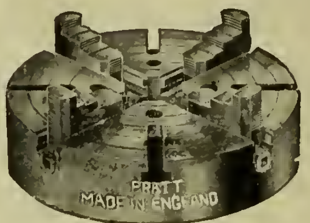

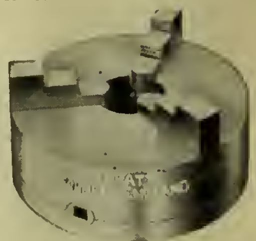

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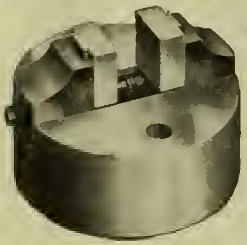

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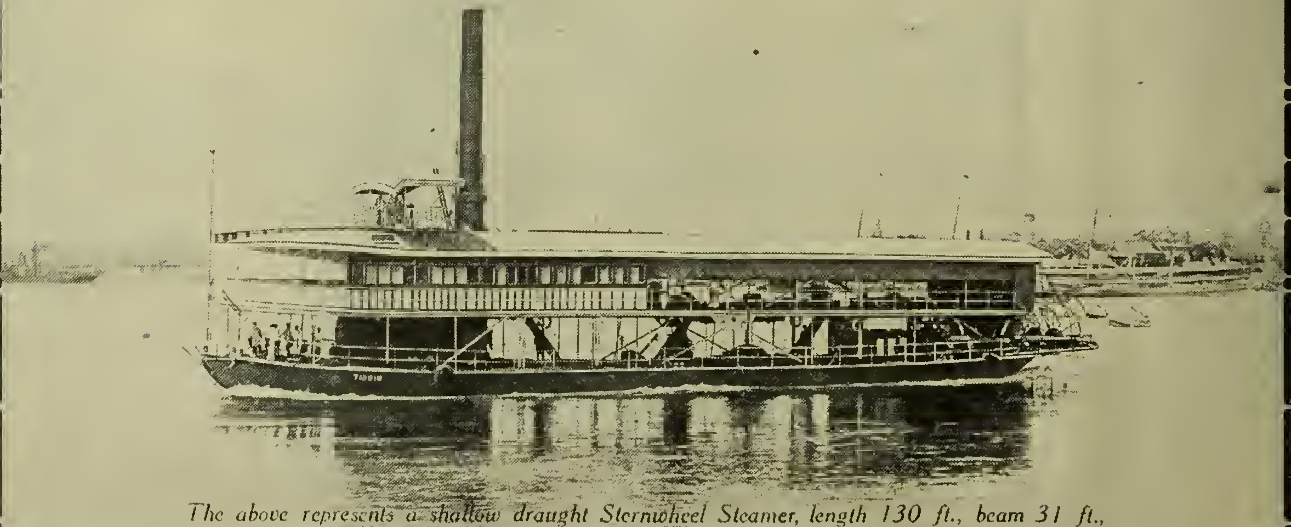

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NOTES AND COMMENTS.

EFFICIENT SALESMANSHIP.

The example of enterprise shown by an American firm of motor car manufacturers and their representatives in the recent demonstration of some of their vehicles in China is one that might well be extensively followed. With the necessary adjustments as to procedure, the moral may be said to apply wherever it is sought to sell foreign manufactured goods in and to the Far East. In the case mentioned the car covered a total of over 500 miles, and was finally sold in Hankow. The car was demonstrated chiefly to the local officials and native gentry, who were greatly interested in its operation and price, and several sales were made. At Kaifengfu, the military governor of Honan not only opened negotiations for the purchase of a car, but proposed the building of a road from the north gate of Kaifengfu to the Yellow River, a distance of about fifteen miles, from where a good cart road follows the river to Tsinanfu, the capital of Shantung. The governor proposes to establish a motor-bus service between these two provincial capitals. The representative who demonstrated this car expressed the belief that not only can passenger cars be operated at a profit in China, but that motor trucks can successfully compete with native cars in carrying produce from the interior to the railway. Though the territory covered in the demonstration is not supplied with roads, in the modern sense, and though the surface of the ancient cart roads is very rough, the demonstrator was convinced that the roadbeds were in fair condition, and that not much work would be required to adjust these highways to motor-car traffic.

PRAISE FOR BRITISH STEEL MAKERS.

Rightly or wrongly, a tendency to self-praise is thought to be a trait of the American people, but those who are tempted to credit this great nation with such a characteristic may well hesitate when they think of Professor Albert Sauveur, of the Harvard University, and his recent address on steel production. The Professor admits that, if all the contributions of American metallurgists and scientists to the art of making steel had never been made, iron and steel would continue to be manufactured, worked, and treated practically as they are to-day—in reduced proportions, to be sure, but of unimpaired quality. On the other hand, if the contributions of English metallurgists and scientists were withdrawn the entire structure of the iron and steel industry would ignominiously collapse. The industry would have neither puddling furnaces, nor crucible steel, nor Bessemer steel, nor open-hearth steel, nor rolling nor forging appliances. Professor Sauveur thinks that America's contributions to the industry have been chiefly of a mechanical kind, that they have consisted in the main in labour-saving devices and machinery destined to cheapen and speed up production. In this they have been undoubtedly successful, and the importance of speeding up and cheapening production is not to be denied or belittled. Admissions such as these are at once just and generous. In return, one may well congratulate America on the position she holds amongst iron and steel producing nations, and for the commercial genius her manufacturers have shown.

AS OTHERS SEE JAPAN.

A good opportunity has been offered Japan for seeing herself as others see her, the term "others" in this instance comprising mainly Sir John Randles, M.P., who lately visited the East, and the Manchester Chamber of Commerce. The opportunity was provided at a recent meeting of the Chamber. It is believed that Japan seriously intends to become one of the great mercantile countries of the world. Manchester views with concern the support which the Japanese Government gives the cotton industry and the manufacture of cotton goods in subsidising steamers carrying the goods. General recognition is given to Japanese initiative and push Much has been said in the past as to the improper use of Trade Marks in Japan, and as to commercial methods followed in certain other directions. Sir John Randles rightly attributes this to the fact that until the Japanese began their rapid Westernisation business had been left to lower types of men. But this will not continue, and it is recognised that a change is already coming in Japan. It is believed that Japan is making sincere effort to bring her great commercial interests up to date, and put them on straight lines, and that Japan is sincere in her earnest desire for Great Britain's friendship. Sir John urges that it is for Great Britain to honour and try to appreciate the Japanese, as they have tried to appreciate Great Britain; that the interests of both countries are really the same, and although in certain directions both are competitors, room exists for both in the markets of the world. Altogether, a very friendly and appreciative opinion was given, sufficiently outspoken to prove of value to business interests in Japan, and so commendatory that it should prove pleasing.

GOVERNMENT ASSISTANCE FOR BRITISH COMMERCE.

A booklet has been published in London, setting forth the important objects and work of the Department of Overseas Trade; also the spirit in which its labours are conducted. Those who know and use the Department—and we ourselves are amongst the number—will probably deem that its important aims and achievements are rather under- than over-stated in the pamphlet just issued. Nevertheless, the book is to be welcomed, and its wide circulation much to be desired. It sets out in detail the way in which the Department is prepared to assist British trade, and, as Mr. Kellaway, M.P., the Parliamentary Secretary, points out in the opening chapter, the more frequently British traders have recourse to the Department, the more useful it will be. Mr. Kellaway also makes it quite plain that Government interest in trade does not mean interference. The Department helps the trader by distributing information through a variety of media, including the *Board of Trade Journal*, and by supplying details concerning contracts open to tender, overseas demand for particular goods, suitable agents for British manufacturers and particulars as to best methods of marketing, nature of competition, customs tariffs and regulations, credit conditions, etc. It organises Trade Fairs, with the object of attracting important overseas buyers and bringing them in touch with the British producer. The great success attending these fairs has been subject for general comment and congratulation. The Department also arranges exhibitions of foreign goods and catalogues, and the extent of its endeavours in this connection can be gauged from the succeeding paragraph. It sends abroad expert missions, wholly financed by the Department or in co-operation with trade associations, to study overseas markets. Eleven important missions of this nature have already been despatched. The Department has control of the Trade Commissioner and Imperial Trade Correspondent Service in the Empire; of the Commercial Diplomatic Service attached to the British Diplomatic Missions in foreign countries, and of the British Consular Service. Since its inception in the summer of 1917 the Department has been engaged in building up a much more comprehensive commercial organisation. In the Empire there are now fourteen Trade Commissioners at work, and in place of the handful of pre-war Commercial Attachés, a new service, styled the Commercial Diplomatic Service, has been established. There are some fifty posts in all, and the officers of the Service are stationed in all the more important foreign markets. With the exception of quite a nominal charge for special services and confidential information, use can be made of the Department free of charge, and no preferential treatment is made between the large and the small firm, or between the manufacturer and the merchant. A study of what the Department has already done, and of its potentialities for increased utility, shows how directly and immensely beneficial Government assistance, as it is rendered by the Department, is, and can be, to British export trade.

EXHIBITION OF FOREIGN SAMPLES.

During the month the Foreign Samples Exhibition of the Department of Overseas Trade has been opened in London at the new quarters in Old Bailey. Something like 80,000 samples from all parts of the world have been collected, and from these British manufacturers should be able to gain a very clear idea as to what their competitors abroad are doing, and as to what the overseas markets require. The scope of the exhibition is very wide, and the samples of machinery are for the most part small. At the same time, engineering to-day enters into so many industries, that the exhibition should be of great value to the manufacturing engineer. The Department of Overseas Trade may well be congratulated on the results so far being achieved. It is part of the duty of officers of this department to send home sets of samples of foreign goods, the competition of which is affecting the sale of British manufactures. At the same time, they report the prices and terms of sale, and give particulars concerning the purchasers. These samples and particulars are made available to manufacturers and exporters of British goods, but not to importers of foreign goods. Special ranges of samples are sent for exhibit to the industrial districts interested in order that manufacturers may have practical illustrations of the competition which they have to face. Sixty-nine thousand manufacturers or merchants have inspected these object lessons; and 4,000 samples have been loaned to firms. As a complement to the samples exhibition, a collection is available of 15,000 foreign trade catalogues, which are lent to United Kingdom manufacturers at the rate of about 1,000 per month. The value of the latter feature is perhaps insufficiently realised. Many of the catalogues are, of course, in foreign languages, and many are of a voluminous nature.

AMERICA AND THE COPRA TRADE.

Increased enterprise on the part of the United States may be anticipated in an endeavour to maintain her position in the vegetable oil industry, particularly as regards the coconut oil and copra market. During the progress of the war the manufacture of all types of edible vegetable oil products received a great stimulus in America. Although by far the larger share of the imports of coconut oil into the United States is consumed by domestic manufacturers, that country has also become an important exporter of the product. Prior to 1919 exports were relatively unimportant, but in 1919 they suddenly expanded to 126,566,000 lbs. Since then there has been a heavy decrease, which is giving cause for some concern. European buyers of copra and coconut oil are endeavouring to divert the trade in these products from the United States to their own ports. Great Britain especially is showing a determination to regain the trade in vegetable oils which was lost during the war. A large share of the territory that produces coconut oil and copra is under British control, and the tendency has been to divert the exports of the Colonies and Protectorates to the British market. British interests are active in establishing oil mills throughout British Colonies, and recently three of the largest oil plants of the Philippine Islands passed under British control. In these circumstances, a more vigorous policy of development may be looked for on the part of America.

JAPAN'S FINANCIAL STABILITY.

For a long time past the question of Japan's financial stability has given serious concern amongst business interests abroad, particularly, perhaps, in Great Britain. The accepted view in commercial circles in this country now is that Japan is financially stable. They base this view on the steady decrease in the issue of paper money and of loans, and the increase in gold reserves. They understand, moreover, that the more important banking institutions are well supplied with funds. To-day, of course, Japan is a creditor rather than a debtor nation, and comparisons between her position to-day and that at the close of the Russo-Japanese war are all in her favour. Wide circulation has been accorded in London to the views recently expressed by Mr. Incouve, Governor of the Bank of Japan, and his statement that financial disturbances in Japan have now practically subsided. A period of comparative commercial inactivity is, however, anticipated, due to the fact that employers and companies have been affected by the recent set-back in trade, causing a falling off in the nation's producing power. Whilst Great Britain may exercise great caution in business transactions with Japan, the latter country's present position is regarded as sound, and the outlook satisfactory.

EXPORT CREDITS SCHEME.

As noted in these pages at the time, on October 25 the British Government announced that the amount of the Treasury advance would be increased from 80 to 100 per cent. of the cost price of the goods supplied to the countries so far coming under this scheme. The original scheme came into operation in September, 1919, and up to October 13, 1920, credits had been granted up to £451,000, whereas, between October 25, 1920, and December 8, the credits approved amounted to about £952,000, including £200,000, provisionally sanctioned. Thus the amount approved during the last six weeks is more than double the sum sanctioned during the previous twelve months. This fact, of course, shows the beneficial effect of granting the increased percentage. The advances actually made during the first period totalled £79,457, against £42,271 for the second period.

RAILWAY DEVELOPMENT AND FINANCE IN CHINA.

Statements of great interest and importance were made by Mr. Sidney F. Mayers, at the recent meeting in London of the British and Chinese Corporation, Ltd., relative to railway development and finance in China. Mr. Mayers, who represents the Corporation in China, has been home on leave, and his remarks on the occasion in question clearly summarise the position. They have, of course, special value for those who have not kept closely in touch with recent happenings, and they show how real and substantial will be China's requirements for railway plant and equipment.

As Mr. Mayers stated, through the instrumentality of the Corporation and its associated company, Chinese Central Railways, Ltd., and the Hongkong and Shanghai Banking Corporation, acting on their behalf, Chinese Government Railway Loans to the amount of some £12,000,000 have been issued on the London market, and loans and advances amounting to about £2,000,000 have been made through the same channels to the Chinese Government for railway purposes. Each of these transactions has necessitated the negotiation of loan agreements which in most cases are of a complicated nature. They include not only the financial conditions under which the capital is to be furnished and repaid, but also provisions regarding the method of its expenditure, and the appointment of the engineering and accounting staff to be employed. These agreements are for long periods, in some cases for 30 or 40 years, and they have in some measure the nature of international treaties.

As in the case of actual treaties their fulfilment without undue friction requires constant attention, and it is Mr. Mayers' function to deal with the Ministry of Communications in all matters arising from these agreements. He testified to the good work done in recent years by that Department in their administration of the railways. Since 1915 the accounts of all the Government railways have been kept on a uniform system which has been evolved by a commission of the chief accountants of the various railways under the supervision of the Ministry of Communications. The figures for the year 1919, show an increase in operating revenues of 44 per cent. in the five years since this uniform system of accounts was introduced, and an increase in operating expenses of 28 per cent. while net revenues during the same period have increased by 64 per cent., and the operating ratio has decreased from 53 in 1915 to 45 in 1919. During the same period of 5 years the return on the capital invested has increased from 6.4 per cent. to 10.7 per cent. These good results have been due, of course, to a considerable extent to the enhanced value of silver, which has enabled the railways to pay interest and amortisation charges with about half the amount of silver formerly required to meet these charges. Nevertheless the railways show an all-round growth of earning power.

As regards the future, Mr. Mayers urges that there is a fortunate aspect in the situation. The great difficulty in the past has been the prejudice of the Chinese people against the opening up of their country by railways, but this phase has passed. The financial results of the railways and their use in the development of trade have convinced Government and people alike that their further expansion is an urgent necessity. There remains the difficulty in these times of financial stringency of providing capital for new construction. During the three years before the war China was in the throes of revolution and was not in a position to utilise that period of relatively cheap money for constructive purposes. During the whole of the war period the markets of the Western world were not in a position to finance her; and during the present period of reconstruction other countries' own needs naturally must be satisfied before capital can be encouraged to seek foreign fields of investment. At the same time the formation of the new Consortium will eventually distribute amongst four markets the task of raising capital for further railway development, and it is the declared policy of this new Consortium, with which the British and Chinese Corporation is connected through the Hongkong and Shanghai Banking Corporation, to offer its services to the Chinese Government in the endeavour to raise part, at least, of the large amounts required in China itself, in silver, from Chinese and foreign sources. Opinions differ as to the possibility of doing this, but Mr. Mayers's opinion is that with adequate safeguards the Chinese capitalist will gradually become accustomed to lend his money to the Government of his country without fear of losing it. The outlook thus depends now primarily on the possibility of raising capital, though the factors of exchange and the price of railway materials will also continue to be important considerations, coupled with the necessity for the re-establishment of the authority of the Civil Government.

THE ARSENIC INDUSTRY IN JAPAN.

BY VICE-CONSUL H. T. GOODLER.

Arsenic is found in Japan as an ore, as well as being a by-product from the smelting of copper and lead.

Ore deposits are said to be fairly large in the Prefectures of Oita, Miyazaki, Hiroshima, Hyogo, Shimane, and Okayama, their percentage of arsenic ranging from 15 to 30 per cent.

In 1918, 1,828,198 lbs of ore, valued at $9,204, were produced. The output increased to 2,133,281 lbs. in 1919, but its value decreased to $6,975. This did not include ore used at the mines by the companies for producing arsenious acid, or crude "arsenic."

Concerning this "acid," available statistics give the total production in 1918 as 877,651 lbs, and 2,862,653 lbs. in 1919. Its exact value is unobtainable, but may be estimated from the declared export returns of Consulates in Japan, excluding Taiwan and Dairen. The total export to the United States in 1919 is given as 1,821,340 lbs., with a value of $70,739, of which 1,387,388 lbs., valued at $48,337, were from Yokohama. The total export from Yokohama to the United States during the first seven months of 1920 is stated as 1,102,020 lbs., valued at $39,510.

Arsenious acid is produced in Japan by direct reduction of arsenic ore and also as a by-product in copper and lead smelting. The former method has been used on a small scale for the last ten years, but only quite recently have by-product methods been installed by certain copper and lead mining companies in endeavours to consume poisonous gases, etc., from smelting operations.

Under the direct method of producing arsenious "acid" one company is said to have a capacity of about 3,333 lbs. at a firing. The charge is renewed about twenty times a month. From ore of 20 per cent. arsenic the output of one furnace will make approximately 13,333 lbs. of crude arsenic each month. About 20 per cent. is lost in refining.

The three largest manufacturers of arsenious acid in Japan are said to approximate a monthly output of 70 tons (crude only), 30 and 15 tons (both refined), respectively.

The arsenic content of acid thus produced by both methods is, roughly, 95 per cent. in the crude and about 97 to 99 per cent. in the refined.

If the industry is given adequate support by large companies, it is claimed that 4,000 tons of acid per year can be produced from known sources.

There are no imports of this "acid" into Japan, so far as known.

As the acid is used in Japan only in the preparation of a few medicines, in the manufacture of insecticides on small scale, and occasionally for wall-paper colouring, etc., the greater part of the annual production is available for export—largely to the United States, Great Britain, Australia, and a little to the Philippine Islands. As the Japanese Government export returns do not list arsenious acid separately, it is impossible to state the small amounts going to countries other than the United States.

It is stated that arsenious acid for export must always have a certificate of analysis by a public chemical laboratory attached to the export documents of each shipment. Analysis of crude acid by one copper-mine laboratory shows the following composition:—

	Percentage.
Arsenic (by distillation)	86.89
Iron oxide	.39
Sulphur anhydride	1.11
Zinc	.21
Lead	.26
Antimony	.04
Selenium and tellurium	.03
Moisture	.40
Others	.77
Total	100.00

The following test for purity, as given by this laboratory, is said to be the usual one adopted by chemical laboratories in Japan:—Five-tenths of a gram of arsenious acid is boiled to a solution in a little water with 3 gram of bicarbonate of sodium. The solution is then allowed to cool, and is diluted with water up to a total volume of 100 cubic centimetres. From this 10 cubic centimetres of solution is drawn off into a test tube and shaken. An ordinary iodine solution is then added drop by drop until the "fading" action of the iodine upon the original solution becomes rather neutral. A few drops of starch paste is then added, and a few more drops of the iodine solution are poured in until the whole reaches a fast-blue colour. The quantity of iodine solution required, multiplied by 0.00495, gives the net content of arsenic.

ENGINEERING, MINING AND INDUSTRIAL PROJECTS IN THE FAR EAST.

TOKYO UNDERGROUND RAILWAY.

It is reported that the proposed construction of the Tokyo Underground Railway will be taken in hand very shortly. The Shinagawa-Asakusa line will be the first to be constructed. Upon completion of the work, which will take some three years, the distance between Shinagawa and Asakusa Park will be covered in less than half an hour.

PUBLIC WORKS AT KWANGTUNG AND SAGHALIEN.

Advices from Tokyo state that the Budget for Korea will amount to 170,000,000 yen, showing an increase of 50,000,000 yen. The Budget for the leased territory of Kwangtung will amount to 15,000,000 yen, the most important item being the defensive equipment of the Manchurian Railway. The Budget for Saghalien will amount to 13,000,000 yen, including the sums to be expended on harbour works.

RECENT JAPANESE PROJECTS IN PHILIPPINES AND NETHERLANDS INDIES.

Recent Japanese enterprise includes the purchase by Japanese financiers in the Philippines of an entire island for $500,000, or in other words, the purchase of concessions for purposes of agriculture covering the whole of the island. A Japanese company that is in the market to buy the Djojogrongang, Sragu, and Demangan estates in Central Java is also negotiating for the purchase of the Ngupit and Ketandan estates, and a site has been selected at Klaten for a new Japanese sugar factory. The Sumber Lawang estate, of 1,500 bouws (a bouw=17,537 acres) on the railway line between Surakarta and Samarang, has passed into Japanese hands for a consideration of fl.600,000, after changing hands in 1918 for fl.70,000, while the Gadaren sugar estate has been bought for fl.1,900,000. In order to offset these developments on Japan's part a larger investment of European and American capital is being called for.

JAPANESE STATE RAILWAYS ELECTRIFICATION.

The Swedish Commercial Attaché at Tokio reports in connection with the electrification of the Japanese State Railways that he has been informed at the Ministry of Railways that it is intended to convert from 500 to 700 miles to electric traction during the next five years, starting with the lines leading into the capital. It is proposed to ask Parliament to grant a further estimate for a considerable sum so that adequate funds will be available for the execution of the programme in question, and a generating station of 110,000 kw. is to be built for the purpose. No definite decision has been reached regarding the system to be adopted, but it is proposed to send the chief engineer to the State Railways to Europe and the United States next year on a tour of investigation, and the engineer is said to consider it probable that it will be necessary to place large orders for plant in other countries.

YOKOHAMA'S FOREIGN TRADE.

For the purpose of developing the foreign trade of Yokohama, a syndicate will shortly be organised by joint efforts of the local authorities and Japanese exporters.

MANUFACTURE OF RUBBER GOODS.

The subject of cotton growing is closely connected with the rubber industry. It is thought that if long staple cotton can be put on the market at a reasonable figure the position of the rubber grower will be strengthened considerably. Investigations towards this end are being conducted in the Far East, and new industrial projects are likely in territory where cotton and rubber are near at hand. Satisfactory progress has been made by the new Japanese rubber goods manufacturing industry and by a similar enterprise at Singapore. A wide market exists for such products. Many portions of the Far East are well placed for development in this connection. The notice of British manufacturers is being called to the matter, and their co-operation suggested. As a further inducement it is pointed out that if such manufacturers established branches abroad not only would they often be favoured by local conditions but their enterprise would do much to stimulate and wisely direct the course of those industries supplying the raw material. If such branches were established, moreover, manufacturing difficulties in one country would be less likely to affect the whole supply of finished goods.

AIR SERVICE BETWEEN PEKING AND SHANGHAI.

The Cabinet has sanctioned the inauguration of an air service between Peking and Shanghai, with three intermediate stations and eighty landing grounds. It is hoped that after carrying the mails for six months a public service will have been secured which will carry both passenger and goods traffic.

NEW TRADING CORPORATION FOR CHINA.

The Amalgamated Trading and Industrial Corporation has been recently formed to take over the business carried on by the British Manchurian Corporation, and will carry on and develop the business of merchants, agents, contractors, and concessionaires in China. With these objects in view it is proposed to issue at an early date 200,000 10 per cent. income bonds of £5 each. The co-operation has been secured of some of the most important houses and institutions in North and South China in business of every nature, invariably with the co-operation of Chinese capital, affording ample proof of the enormous potentialities awaiting a British corporation formed under the right auspices with sufficient capital and credit.

ESTABLISHMENT OF AN IRON INDUSTRY IN NORTH CHINA.

Details of the proposed new iron works at Chinwangtao have appeared from time to time in these pages. The position and prospects of the project were clearly summed up by Mr. W. F. Turner (chairman) at the recent meeting in London of the Chinese Engineering and Mining Committee, who, with the Kailan Mining Administration and the Lanchow Mining Co., are concerned in the enterprise.

Some considerable time ago it came to the knowledge of the Kailan Mining Administration that there existed a large deposit of iron ore on the Yangtsze River, which was owned by a Chinese company, and it was suggested that in view of the administration's exceptional position in regard to the supply of coal, the deposit might be worth investigating with a view to the establishment of iron works in North China. An examination was made, and a preliminary option was obtained for a sufficient period to allow of an expert being sent out from Europe to examine and report upon the deposit. The subsequent report showed that the deposit contained about 4,000,000 tons of workable ore, that it was of high grade, that the situation was favourable, being only about 11 miles from the Yangtzse River, that the deposit could be worked by open cast, that there was abundant labour, and that conditions generally were satisfactory. A contract was therefore made by the Kailan Mining Administration securing this supply of ore on suitable terms.

The intention is that the works shall be located at Chinwangtao, which is the port controlled by the Kailan Mining Administration and the seat of its export trade. Borings have been made for the purpose of locating a suitable site. and the results which have recently come to hand are being studied. Plans are being prepared for the general lay-out and detailed designs of the blast-furnace plant and preliminary estimates of the expenditure which will be entailed by the scheme. There are many matters still under investigation, and it is too early to give figures as regards profits or capital expenditure. In due course the project in its present form will be submitted to the board of the Lanchow Mining Company, who are partners with the Kailan Mining Administration, and the subject discussed with them from the technical, commercial, and also the financial point of view. The question of the establishment of an iron industry in North China is one of the greatest importance, and the Kailan Mining Administration, in the immense resources of the Kaiping coalfield, the facilities it possesses in the port of Chinwangtao, and in its technical and commercial organisation, and in the cheapness of the labour available, has every possible advantage for creating a profitable enterprise.

INCREASED SHIPPING FACILITIES AT CHINWANGTAO.

The shipping facilities at Chinwangtao are already inadequate, and it is necessary that they should be largely and rapidly increased to enable the increasing business to be handled efficiently. After much study, the conclusion is that the best means of attaining the object is to build an entirely new breakwater outside the existing one, and to provide in the first instance five additional berths, making twelve in all. This work will be spread over a period of about three years; it will be undertaken by the staff of the Kailan Mining Administration, and will begin in the spring.

RAILWAY DEVELOPMENT IN CHINA.

Presiding at the meeting of the British and Chinese Corporation, Ltd., held in London during the month, Mr. C. C. Macrae stated that construction of the Hupei-Hunan section of the Hankow Canton Railway and its continuation southwards will be undertaken as soon as conditions permit a further issue of Hukuang Railway bonds to be made on terms acceptable to the Chinese Government and the Consortium. At the same meeting Mr. Sidney F. Mayers spoke relative to railway finance and development in China. His remarks are dealt with elsewhere in this issue. They illustrate the great potential markets now developing in this country for railway material and equipment. The importance of the projects materialising in this direction cannot very well be over-estimated.

COTTON TRADE MISSION TO THE FAR EAST.

The mission which the cotton trade of Lancashire has arranged to send to the Far East is expected to set out early next year. It will have a strong representation of labour, in order that the workers in Great Britain may be better able to understand the problems which have to be faced.

RUBBER GOODS IN MUKDEN.

Reporting on the conditions at present existing in Mukden, the American Consul at that place points out that while the market for rubber goods is small, it is growing, and excellent trade results will be had by firms who are willing to grant long terms of credit when so desired, and who push goods through actual representation rather than by correspondence. There is a demand for standard size automobile tyres, the quick detachable type, straight side, being the most popular. A large market for raincoats would be provided by catering to the Chinese tastes. The Chinese prefer long coats, from 4 ft. 2 in. to 4 ft. 10 in., with wide collars and cuffs and inside slash pockets. There is a fair demand for pneumatic pillows, the most popular size being 8 in. by 14 in. Native firms in this district could easily be induced to handle, in addition to the above, such rubber articles as combs, boots and shoes, hot-water bottles, sponges, balloons, engine and tender hose, air hose, steam hose, suction hose, linen hose, smooth and rough-finish gloves, soles and heels, and rubber cloth, provided that suitable credits could be arranged.

COAL MINES IN BRITISH MALAYA.

So satisfactory has been the results attending the working of the coal mines at Rawang, in the State of Selangor, that the suggestion has been put forward of doubling the company's capital to extend its operations in Malaya and adjacent countries where prospecting has been undertaken. In the working year ending June last, sales of coal amounted to 200,707 tons, as against 179,834 tons in the previous year. Profits amounted to $505,872 (£59,018), a dividend of 25 per cent. was paid, and $150,000 transferred to general reserve, which now stands at $610,000. The mines are equipped with plant and machinery of the best make procurable in England, and the management hope before the end of the new financial year to have a monthly output of about 60,000 tons. Compared with the greater part of the world, fuel in the Federated Malay States is cheap. The local coal would be worth in Europe fully 100 per cent. more at pithead than the Malay collieries are charging their consumers.

TIMBER SUPPLIES FROM BRITISH MALAYA.

Mr. E. Cubitt, the Conservator of Forests in the Federated Malay States and Straits Settlements, issues a very interesting report on the work of his Department last year. It shows that valuable progress is being made in forest research, especially in connection with the collection of information regarding the commercial timbers of the country and that such progress is directly helpful to many established industries and may open up new industrial projects

Every effort was made during the year to extend the uses of indigenous timbers, and the fact has been established that seraya, bintangor, sepetir and merawan all make serviceable furniture. Mempening merah would be useful if it were available in sufficient quantities, and nyireh, which is to be used (probably in combination with tembusu) for panelling one of the new railway coaches, seems likely to prove suitable even for fine cabinet work. The information collected on the uses of timber has been made available to other departments of the Government and to the public, and inquiries were answered as to the use of woods for oil barrels, rubber-boxes, matches, tool handles, billiard cues, house-building, shingles, furniture, panelling, walking-sticks, glove boxes, golf clubs, violins, carriage-shafts, frames for motor car hoods, body work for goods wagons, tin-mining machinery and dredges, wood distillation, bridge-building, etc. There is no doubt that a greater general interest has lately been aroused in the timbers of the country. A match factory has been established in Selangor, and there are good prospects of wood distillation on a large scale being begun in Pahang.

AGRICULTURAL PROJECTS IN F.M.S.

Although over-production in rubber is regarded as a passing phase by those engaged in the industry, it is serving to force attention to other forms of tropical agriculture, and several new projects are materialising. For some time past, of course, the Agricultural Department of the Federated Malay States have been experimenting in new cultures suitable for a tropical climate. Reserves for large-scale experimental work on crops other than rubber have now been made in the whole of the four States. It was proposed to commence work on the Selangor Station this year. This reserve comprises about 2,500 acres, and is fairly easy of access from Kuala Lumpur.

What is being done with regard to the African oil palm has already been set out in these pages, and in the State of Johore a considerable area is being planted with this palm. Land in the neighbourhood of Gunong Angsi, in Negri Sembilan, and Ginting Sempah, in Selangor and Pahang, has been reserved for the cultivation of cinchona. Inquiries are being made as to whether it is advisable to arrange to manufacture quinine locally or to export the bark. The cultivation of castor oil on a commercial scale has been undertaken by a number of estates in the F.M.S., and results show that this crop is more one for the small holder. Mr. Lewton-Brain, the Director of Agriculture, reports that ipecacuanha plants in the gardens continue to grow well. A considerable amount of planting material was distributed and information supplied on the cultivation of patchouli. The Brazil nut continues to do well in Malaya.

The Department reports that the *Aleurites montana*, a species of tree growing in China and contiguous countries, does well in the Federated Malay States. It is from the *Aleurites* that tung or Chinese wood-oil and candlenut oil are obtained. Tung oil belongs to the class of vegetable oils known as drying oils, and is thus similar to linseed oil, and can be used for similar purposes, such as the manufacture of paints and varnishes or the manufacture of linoleum. It is probable that, since the drying properties of the oil are not as good as those of linseed oil, the oil may be used largely as an adulterant of linseed oil. It is stated to be the quickest drying oil known, but inferior to linseed oil on account of its opacity and the elasticity of the skin produced in drying. It is used largely in China as a natural wood varnish and waterproofing material.

MUNICIPAL SCHEME FOR SINGAPORE.

The Municipal Commissioners have appointed a sub-committee to consider a scheme for the erection of new Municipal Offices on the site of the Victoria Memorial Hall and theatre (which would be rebuilt), these forming part of one large civic centre, including Government offices, law courts, etc., at an estimated cost of $3,500,000.

PAPER MAKING IN THE F.M.S.

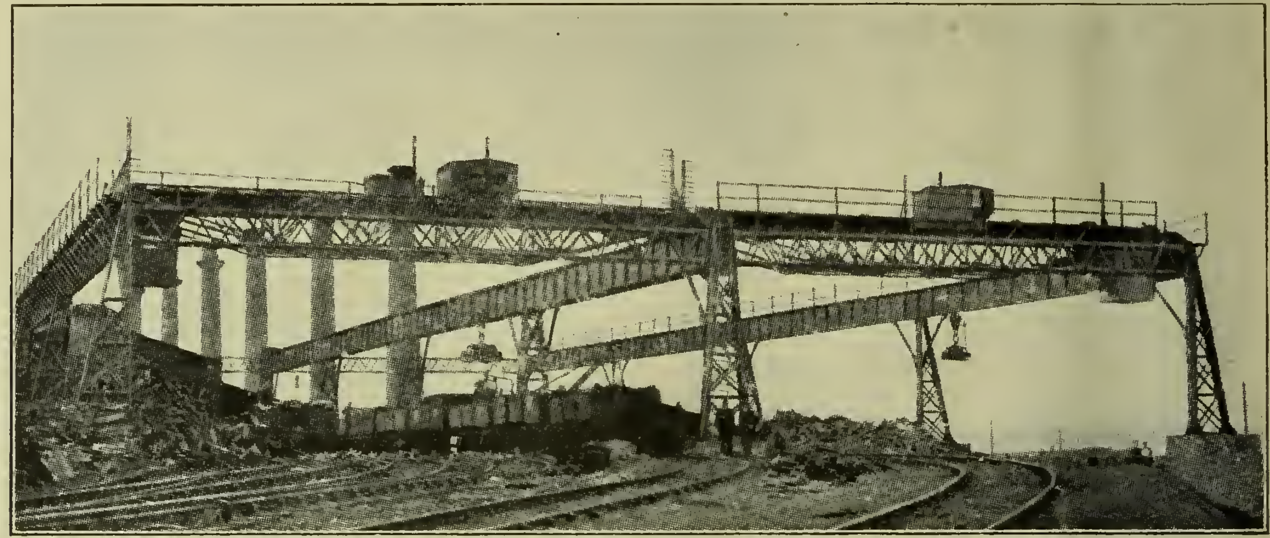
Paper making machinery is being installed in Kuala Lumpur by the F.M.S. Government for experimental purposes. For the present, it is proposed to begin the manufacture of paper by the conversion of waste paper. The Agricultural Department are sponsoring the experiments.

MACHINERY FOR TEA FACTORIES IN DUTCH EAST INDIES.

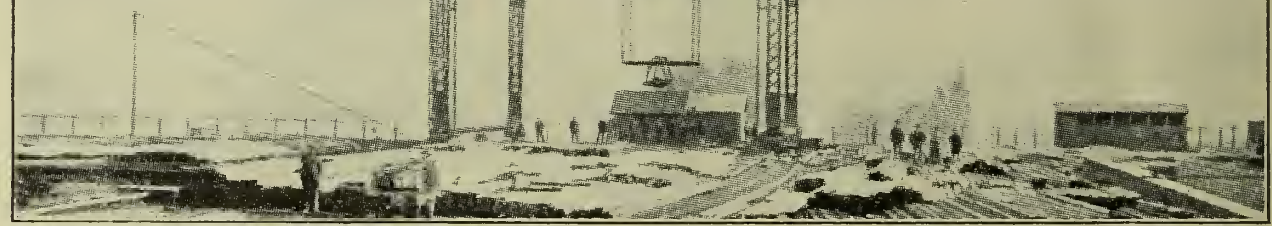
Machinery for the tea factories of the Dutch East Indies is primarily supplied by England, whose manufacturers have catered to this trade for many decades. For nearly all of the 120 tea estates in the islands there is a factory to handle the output, and these mills constitute a market for rolling machines, ball breakers, fans, and drying and grading machines. In many of the tea estates overhead cableways for the transportation of tea leaves to the factories are being installed to replace the system of delivery by the pickers. The further installation of these transportation lines will involve the purchase of large quantities of cable and other equipment.

TRAVELLING, TRANSPORTER AND FLOATING CRANES.

The installation of improved transport equipment for industry and commerce and of the necessary appliances for the mechanical handling of goods offers problems in the Far East which still very largely await solution. It is certain that important contracts for this class of machinery must be placed, as the large improvement schemes in connection with harbour works, docks and railway terminals now in hand or under consideration in this part of the world reach fruition. Of the class of equipment in question, certain descriptions, chiefly relating to the lighter class of plant for use in warehouses and in commercial rather than industrial centres, have already been dealt with in these pages. The particulars given on this occasion deal with the electric overhead travelling, transporter and floating cranes manufactured by the Wellman Smith Owen Engineering Corporation, Ltd., of Darlaston. This class of plant, of course, applies to widely divergent conditions of service to those appertaining to the machinery treated in recent articles, although it clearly belongs to the same group and forms an important section of modern appliances for the mechanical transport and handling of materials and merchandise.



7-Ton Electric Overhead Travelling Cranes and Gantries. Span, 58 feet.



10-Ton Electric Cantilever Transporter Crane for Stock Yards, Ship Yards, etc.

The Wellman Smith Owen Engineering Corporation, Ltd., it may be mentioned, incorporates two very well-known firms, Messrs. Wellman, Seaver & Head, Ltd., and the James Smith Hoisting Machinery Co., Ltd. The present corporation are designers, engineers, and manufacturers of all types and capacities of hoisting machinery, and it will be found that up-to-date ideas have been literally introduced into their designs. This fact is very plainly indicated in the following details, which also show the high standard of materials and workmanship employed.

The accompanying illustrations clearly show the class of equipment we are concerned with on this occasion. In the girder construction for such plant mild steel of British manufacture is used throughout, having an ultimate tensile strength of 28 to 32 tons per square inch, with an elongation of at least 20 per cent. in a length of 8 in. The main girders consist of rolled mild steel H-section beams for cranes of light capacity and short span. For cranes of greater capacity and span the girders consist of either box section or lattice type girders. Girders of H-section or of the braced type are fitted with auxiliary or outrigger girders to afford lateral stability and to resist the strains which occur by suddenly starting and stopping the crane, with the fully loaded crab at the centre of the span or when reversing at all speed. Box section girders are built up of plates and angles with a necessary web and flange cover plates. Diaphragms are fitted between the web plates at uniform intervals to prevent the longitudinal motor or gearing from distorting the girders. Girders of the braced type, generally a Warren truss, are built up of mild steel flange plates, angles and flitch plates or channels, the upper and lower booms being connected by vertical and diagonal bracing of either angle or channel section. The auxiliary girders are similar in shape and depth to the main girders, and the upper and lower booms consist of a single angle connected by vertical and diagonal angle bracing. The girders are of ample strength to sustain the maximum load at the centre of the span without permanent deflection, and are so proportioned that the stress per square inch of net section will not exceed five tons under maximum load.

The two main girders are bolted to box-section end carriages designed to resist the maximum bending moment due to the load being lifted at either end of the crane. The materials and workmanship are equivalent to that specified for the main girders. The wheel base of the end carriages is not less than one-fifth of the span. Longitudinal travelling is effected by the motor and first motion gearing located at or near the centre of the span of the main or auxiliary girders on the platform side of the crane. The motion is transmitted by a shaft extending across the girders and fitted with pinions at either end to gear with one wheel in each end carriage, which ensures both ends of the crane travelling simultaneously.

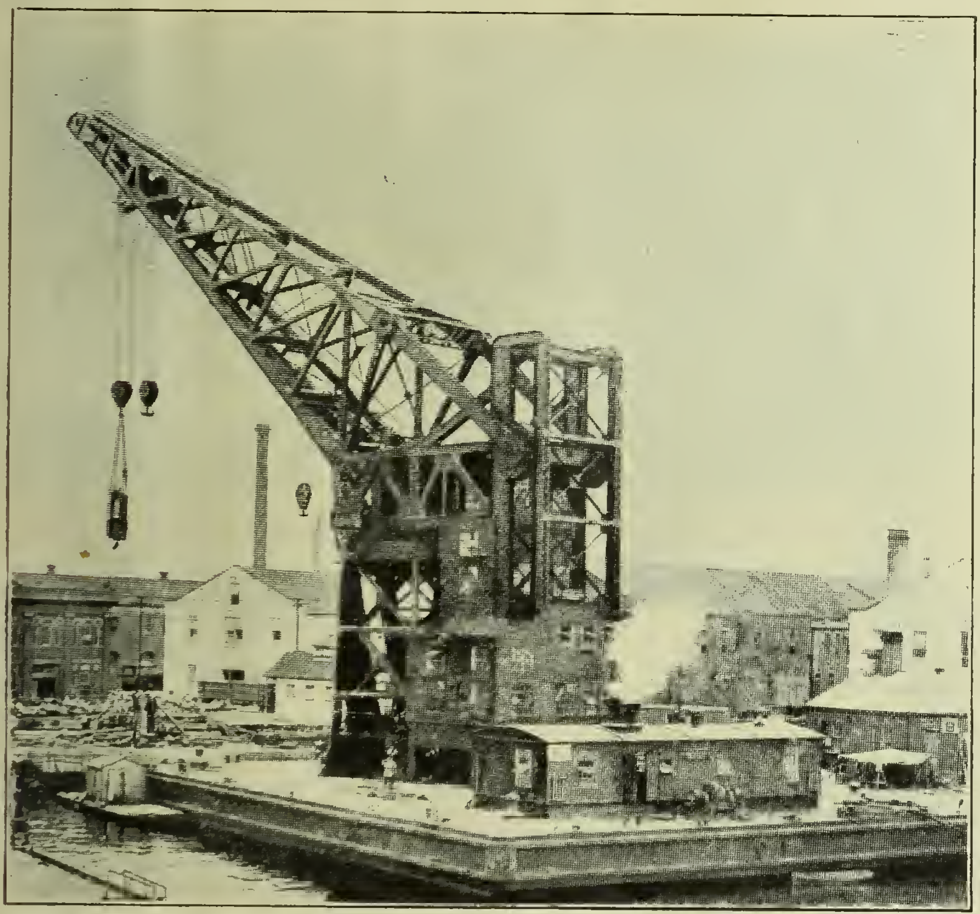
A brake of the Post type is fitted on the cross shaft, and is operated by a foot lever conveniently located in the driver's cage.

The motors are of reversible, slow-speed, enclosed type, specially designed and constructed throughout for the exacting conditions experienced in crane service. They are capable of giving a full load output continuously for a period of 30 minutes or longer, as determined by the nature of the work which the crane will perform, with a temperature rise not exceeding 40 deg. Cent. above that of the surrounding atmosphere. They are further capable of giving a full load output without sparking and of withstanding overloads of 50 per cent. for short periods without injury.

Controllers are of the reversible speed regulating tramway type, with standard crank handles and magnetic blow-out. The resistances are of the protected and ventilated metallic type, liberally rated for crane service.

The standard switchboard consists of a totally enclosed interlocked type of control panel, which is fitted with a contactor breaker and separate relays for the main and each motor circuit, there being no fuses to replace in the event of an overload.

Should the contactor break the circuit due to an overload or failure of the current, the crane driver only requires to bring his controller handle to the "off" position, and the contactor is automatically re-set, and obviates the necessity of the crane-driver leaving the control position. A push-button emergency switch is mounted on the panel within easy access of the driver to operate the main breaker should the necessity arise. A pilot light is also fitted, as an indication to the driver that current is on the line, also a portable protected hand-lamp.



150-Ton Electric Floating Crane with Hoisting, Luffing and Slewing Motions. Radius, 112 feet.

This Revolving Turret Crane represents the latest developments in Floating Crane Construction. The Auxiliary Hoist, of 25 tons capacity, travels up and down on the underside of the jib, with a maximum radius of 122 feet. The Main Hoisting Speed is 4 feet per minute and the full load is luffed from maximum to minimum radius in 17 minutes. Size of Pontoon, 85 x 140 x 15 feet. Maximum list 4° with 2 feet minimum freeboard. Deck storage capacity, 300 gross tons.

Cross wiring on the main girders consists of bare hard-drawn high-conductivity copper conductors, stretched with insulated straining bolts, fixed to insulated mild-steel brackets, attached to each end of the main girders, the current being collected by substantial collectors carried on an insulated adjustable bar fixed below the crab.

The necessary connecting cables between the collectors, switchboard, controllers, resistances, and motors consist of high-quality insulated cable, fitted in position with sweated gun-metal terminals. Where the cables are exposed to mechanical injury, and where otherwise convenient, they are run in steel conduit. The main collectors are carried on an insulated adjustable mild-steel bracket, fixed to one of the end carriages, to collect the current from longitudinal conductors.

The standard grab installed, whilst designed primarily to meet the requirements of iron and steel foundries, is well adapted to almost every description of crane service.

The diameter of the hoisting barrel is not less than 28 times the diameter of the hoisting ropes. The load is hoisted on four or six falls of plough-steel wire rope, and a factor of safety is given of not less than eight to one.

The armature extension shaft of the hoisting motor is fitted with a brake of the band type enclosed in cast-iron case. The brake solenoid is connected with the hoisting motor circuit in such a manner that current passes simultaneously through the solenoid and motor to release the brake. Should the current be shut off, or fail from any cause, the brake comes into action automatically. A hand release is fitted and operated from the driver's cage. It consists of a flexible steel wire cord stretched across one of the main girders, which passes over guide sheaves suspended from one of the crab side-frames. The brake is capable of sustaining the full working load in any position, or of lowering the same by gravity under perfect control. The pressure on the brake is regulated by the driver, and a delicate adjustment of the load in lowering is attainable.

The hoisting motion of cranes of medium and heavy capacity is fitted with the makers' improved mechanical load-brake of the Weston self-sustaining type. This brake is fixed to one of the crab side-frames, is self-contained, dust-proof, and oil-tight. The load is automatically sustained at all times, and cannot descend through careless operation or failure of the current. Lowering of the load is accomplished by reversal of the hoisting motor and the application of sufficient power to overcome the resistance of the friction elements.

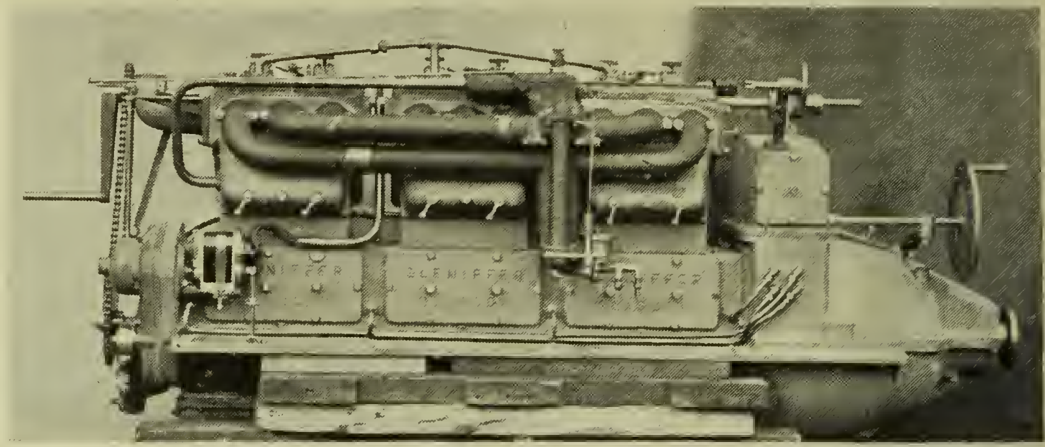
The hoisting motion is fitted with an overwinding device, which is mounted on one of the crab side-frames and consists of an automatic switch operated from the end of the barrel shaft through gearing of small pitch. When the hook has reached a predetermined point in hoisting, overwinding is effectually prevented by an automatic quick-break of the hoisting circuit, and the consequent interruption of the electric supply simultaneously and automatically applies the magnetic brake to prevent the descent of the load.

Petters, Ltd., the oil engine manufacturers, of Yeovil, have paid an ordinary dividend of 5 per cent., tax free, for the half year.

IMPROVED ENGINES AND EQUIPMENT FOR MOTOR CRAFT IN THE FAR EAST.

The accompanying details and illustrations deal with a class of internal combustion engines and equipment very suitable for a wide range of requirements for motor craft in the Far East. The engines and equipment were exhibited at the recent Shipbuilding, Engineering and Electrical Exhibition at Glasgow, where they occasioned a good deal of favourable comment. The makers, Gleniffer Motors, Ltd., of Anniesland, Glasgow, enjoy a high reputation as manufacturers of this description of plant.

The 75-90 h.p. 6-cylinder heavy duty paraffin engine with reverse gear shown has many interesting features. The cylinders, which measure 6 in. bore and 8 in. stroke, are cast in pairs, having detachable heads and inclined valves operated by rocking-lever tappets with rollers running on the cams. In this model the reverse gear is incorporated in the flywheel at the after end of the engine, and is entirely mounted within the crank case, with the result that the outfit takes up very little space fore and aft, and gives a particularly clean appearance. The working of this gear is described later. A unique system of lubrication is employed, the oil being thrown by the flywheel from the sump into an oil-collecting chamber, in which is placed small buckets which catch the oil; from there it is led by gravity through large bore copper pipes to cups above each main bearing. The overflow from these cups supplies the troughs in the bottom of the crank case from where it is splashed by dippers on the big ends to all the remaining working surfaces of the engine. The reverse gear, being in the after end of the crank-case, is, of course, running in oil. This lubrication system is thus entirely automatic and fool-proof. The lower portion of the base chamber is water-jacketed for its entire length, thus keeping the lubricating oil at a moderate temperature. The water circulation is maintained by a gun-metal plunger pump running at half engine speed.


75/90 H.P. "Gleniffer" Paraffin Engine and Reverse Gear.

Engines of similar design with similar type of reverse gear and same system of lubrication are also supplied in 25-30 h.p. (two-cylinder) and 12½-15 h.p. (single-cylinder) sizes.

Messrs. Gleniffer Motors, Ltd., also manufacture a 40-50 h.p. 4-cylinder heavy duty paraffin engine and reverse gear. In this type the trough system of lubrication is employed, in which the level of the oil in the troughs is maintained by a vane type pump. The water circulation is by gun-metal plunger pump. The engine and reverse gear are mounted as one unit on angle-iron bearers, and the exhaust-heated vaporiser is situated at the after end of the engine, coupled direct to the silencer, which is bolted to the back of the after pair of cylinders, thus making the whole outfit a very compact unit for installation in a boat.

A medium duty paraffin 10-12 h.p. 2-cylinder engine is also manufactured by the firm, the cylinders, cast in one block, measuring 4¼ in. bore by 5 in. stroke. It is coupled direct to an enclosed type reverse gear, on angle-iron bearers. The water circulation in this model also is by a gun-metal plunger pump. The lubrication is very simple, A collector wheel revolves with the crankshaft, and carries the oil from a sump in the base hamber, delivering it into troughs below the crank webs; dippers are fitted to these webs which splash the oil to all working surfaces; oil channels and cups are provided where necessary to catch the oil.

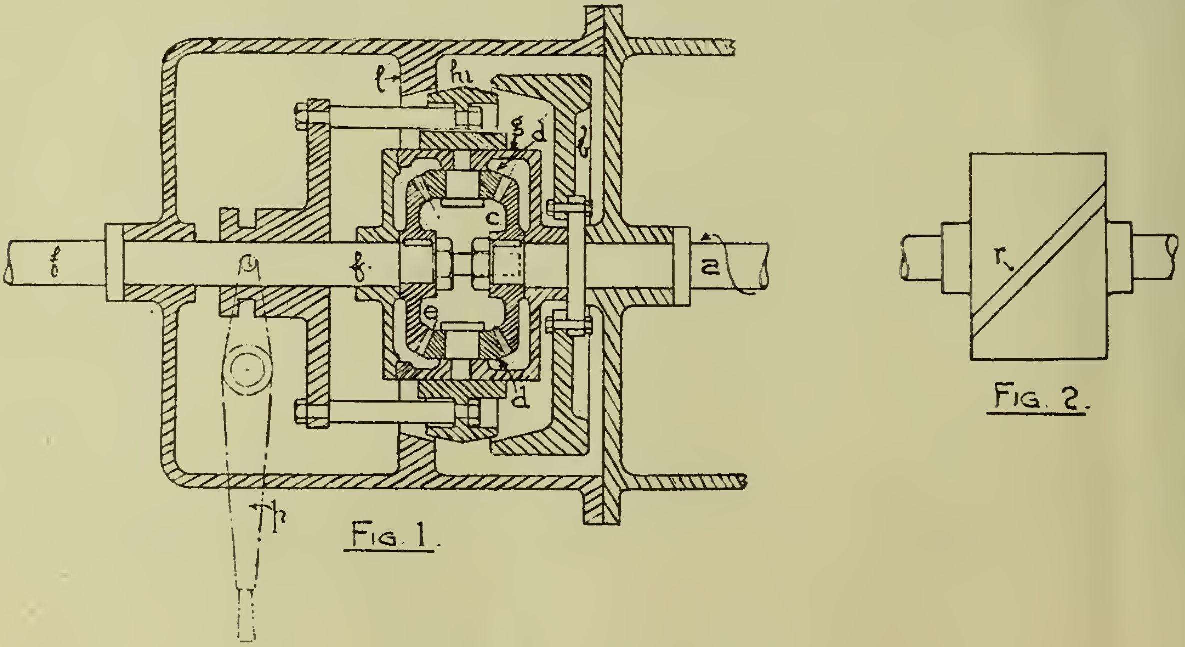


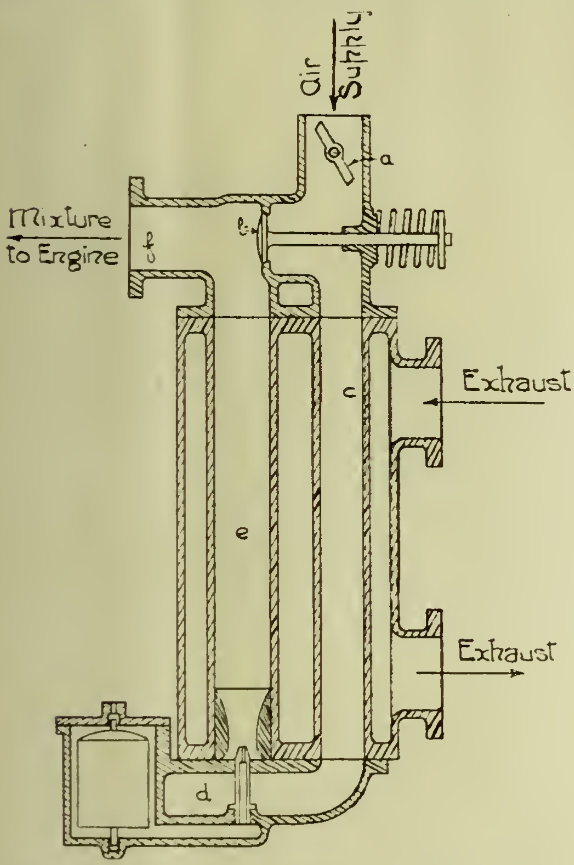
FIG. 1.

FIG. 2.

Diagrammatic View of Reverse Gear.

Reference has been made to the new patented reverse gear installed in the 75-90, 25-30, and 12½-15 h.p. engines. This gear depends for its action on a principle which is a completely new departure for this class of mechanism, and is covered by a patent. One of its outstanding features is that it never requires adjustment.

The working of the gear may be followed by reference to the line drawings in which (*a*) is the crankshaft, (*b*) is the driving clutch member which is incorporated in the flywheel, (*c*) is the driving bevel wheel, (*d.d.*) are intermediate wheels, and (*e*) the driven bevel wheels, the latter being keyed to driven shaft (*f*), (*g*) is the drum on which the spindles of the intermediate wheels (*d.d.*) are mounted. On this drum (*g*) are cut two helical keyways (*r*). On the outside of drum (*g*) is mounted the double clutch member (*h*), to the inner surface of which are secured two keys which fit in the keyways (*r*). This member (*h*) may be moved into engagement with either of the clutch members (*b*) or (*l*) by means of the operating lever (*p*). When (*h*) is moved into engagement with (*b*) the latter tends to carry the former round with it, thus driving the drum (*g*) and consequently the shaft (*f*). At the same time the action of the keys in the keyways (*r*) is to thrust (*h*) to the right and thus keep it in engagement with clutch (*b*). To obtain the reverse action the clutch (*h*) is pulled out of engagement with (*b*) and thrust into engagement with the stationary clutch member (*l*) which brings drum (*g*) to a standstill, thus causing the shaft (*f*) to revolve in the reverse direction from shaft (*a*). In this position the action of the keys in the helical keyways (*r*) is to thrust (*h*) to the left, and thus keep it in engagement with clutch (*l*).



Diagrammatic View of "Gleniffer" Paraffin Vaporiser.

It will now be seen that the operating gear is only necessary to engage or disengage the ahead or the astern clutches. Once either of them is engaged the torque of the engine holds it in engagement. It will also be observed that any wear which takes place on the clutch surfaces will not effect the working of the gear, which requires no adjustments whatsoever. This gear is entirely independent of propeller thrust for engagement of the clutches, thus eliminating the difficulties experienced in gears of that type in which the thrust varies inversely with the boat speed for a given power of engine. It also eliminates the unavoidable fore and aft movement of the propeller shaft that is inherent to that type of gear.

Messrs. Gleniffer Motors, Ltd., also draw attention to the details of construction of their paraffin vaporiser. This, a patented design, is of the exhaust-heated type, and is ingeniously arranged to make use of a physical property of the fuel which completely overcomes the difficulty of vaporisation when running for prolonged periods at dead slow speed. The temperature at which paraffin can be completely vaporised is dependent to a considerable extent on the pressure at which the vaporisation takes place. The lower the pressure is, the lower will be the temperature necessary to cause vaporisation. In a throttle controlled engine running on no load or dead slow a partial vacuum is formed between the throttle and the cylinder. In this vaporiser the throttle is so arranged that the fuel is subjected to this partial vacuum from the moment it leaves the jet until it enters the cylinder and consequently is vaporised under this reduced pressure, which naturally is able to take place at a temperature much below that at which it would be vaporised under atmospheric pressure.

The arrangement of the parts of the vaporiser are as shown in the diagrammatic line drawing, in which (*a*) is the throttle controlling the admission of air which passes down pipe (*c*) where it is heated and passes the jet chamber (*d*) and choke tube in which the jet nozzle is placed. After passing the jet and picking up the fuel it passes through the vaporiser chamber (*c*) to the outlet (*f*). The valve (*b*) is arranged to let cold air pass direct to the outlet (*f*) and mix with the heated mixture from (*c*) when running at full load.

MINING IN THE FEDERATED MALAY STATES.

The Report of the Federated Malay States Mining Department for 1919, just issued, states that the revenue derived from mining amounted to £1,223,738. The export duty or royalty on tin contributed £1,160,154. There was a decrease of 435 tons in the amount of tin exported, the total being 36,935 tons. Of this total, 5,137 tons consisted of pig-tin and 31,798 tons in the form of ore, which went to the refineries in Singapore and Penang. The native smelters appear to have secured a larger share of the ore than in the previous year. The Government, as is well known, were obliged to step in and buy ore at the commencement of the year. They ceased to buy on April 25, when the market was able to absorb all the metal offered. The local price of tin fluctuated from $66 a picul to a maximum of $166, the average price being $120.68, as compared with $150.68 in 1918.

POSITION OF TIN MINING INDUSTRY.

The Senior Warden of Mines, who signs the Report, observes that the position at the close of the year showed no lack of buyers, but it was doubtful if the demand was mainly on the part of consumers, and there appeared to be a considerable volume of speculation. He continues: "Though miners were faced with certain difficulties inherent on world-wide conditions, some of which it was beyond the power of this Government to temper, the year under review may be considered a prosperous one, and it closed with tin at a high price. The future of the industry is to a very large degree dependent on the price of tin—more so than ever before—which price is at a record figure at the time of compilation of this Report; but what the trend of that price will be in the future it is impossible to say, and, while circumstances admit, it would be a wise measure, on the part of all large mining concerns, to build up reserve funds for use in times of emergency, as an industry that cannot help itself during periods of stress cannot be considered to be on an entirely sound basis. As mentioned in the Report for 1918, conservation of and a survey of the tin resources of these States is worthy of grave consideration, from the point of view of the Empire's position in the tin trade and British command of the tin market."

It is significant that in December, 1920, the Federated Malay States Government should be again called upon to save the tin mining industry from disaster by buying ore which the market is not able to absorb—the third time in six years that this has happened.

TUNGSTEN ORE.

The total amount of tungsten ores exported amounted to 435 tons—about 80 tons more than in 1918. The withdrawal of the guaranteed price was followed by an arrangement under which compensation was assessable at the rate of 30s. per unit of tungstic acid. The Raub goldmine in Pahang produced 15,306 ozs. of gold and about 1,100 ozs. were produced elsewhere.

COAL MINING.

The Malayan collieries, Selangor, more commonly known as the Rawang Coalfields, increased their output by 22,553 tons, the total output being 191,293 tons. Of this 87,060 tons were taken by mines and 68,003 tons by the F.M.S. railways, while 24,261 tons were exported. It is expected that an output of 400,000 tons will be reached ultimately. There was a decrease of 31,514 in the number of men employed in mining as compared with 1918, the total number being 113,107. There does not seem to be any clear explanation of this considerable decrease, seeing that the drop in exported mining produce was only about 1.2 per cent.

The question of fuel for the mines is causing concern. It is estimated that 798,363 tons of wood were used in addition to 88,839 tons of coal and 3,397 tons of oil, but some doubt is thrown on the accuracy of these figures, especially as regards wood fuel. Increasing interest appears to be taken in prospecting areas likely to prove suitable for bucket dredging, and 18 dredges were in operation, producing 4,560 tons of tin ore, equivalent to about 8.9 of the F.M.S. output.

The extension of mining operations were impeded by labour difficulties and to some extent by fuel shortage. There has been some prospecting for oil.

THE LATEST MOTOR-DRIVEN VESSEL.

The recent launch from Messrs. Vickers' Naval Construction Works at Barrow of the motor-driven vessel *Seminole* is of special interest, as the new vessel embodies and illustrates many of the methods and developments to which attention has been drawn in recent articles in this journal on motor shipbuilding.

The vessel which represents the latest addition to the ever-growing list of motor-driven ships has been built to the order of the Anglo-American Oil Co., Ltd., and has the following dimensions :—

Length, b.p.	425 ft. 0 in.
Breadth, mld.	56 ft. 8 in.
Depth, mld. (upper deck)	33 ft. 0 in.
Mean draft	26 ft. 0 in.
Displacement	14,000 tons
Total d.w. capacity	10,050 tons
Bunker capacity (oil)	733 tons

She is a sister ship to the *Narragansett*, built by the same firm for the same owners. The performance of the latter vessel has been so successful that Messrs. Vickers claim she is the most economically-operated internal combustion engine afloat. A speed of 10½ knots was guaranteed this vessel at an estimated fuel consumption of 11 tons of oil fuel per day. Actually she ran recently from New Orleans to Liverpool, a distance of 4,500 miles, at 11.1 knots, and used only 9.6 tons daily for her engines, a remarkable record for a seventeen-days trip with 10,000 tons of cargo.

Like the *Narragansett*, the *Seminole* has the Vickers four-stroke engines, which are simplified by having an injection air compressor. The makers have some twenty years' experience as pioneers of the British submarine, and in equipping them with internal combustion engines. The excellent performance of ships equipped with Vickers' internal combustion engines is instanced by the following short *résumé* sent us by the firm :—

M.V. *Circeshell*.—After 14,000 miles the engines were opened out and found to be in excellent condition.

M.V. *Medway*.—On maiden voyage from Hongkong to Balik Papan average speed was 9.5 knots.

M.V. *Oweenee*.—From Clyde to Port Said averaged 9.88 knots for fourteen days with a daily consumption of 4½ tons of oil fuel. This ship has now covered about 17,000 miles without any stop at sea or delay in port.

M.V. *Marinula*.—An oil-tanker of 9,916 tons d.w. with s.h.p. of 2,500. In Admiralty service in Persian Gulf during the War. She was bought by the Anglo-Saxon Petroleum Co. in 1919 and refitted last July for a single trip pending alterations to suit her new owners, but has been running for the last four months in the Gulf of Mexico without any main engine trouble.

R.F.A. *Trefoil*.—Oil tanker of 2,390 tons d.w., 1,500 s.h.p, In service for eighteen months without opening any cylinder' and refit only eventually required owing to breakdown of steam plant. This ship was constantly in attendance on the British Fleet during the War.

H.M.S. *Marshal Soult*.—This ship did strenuous work off the Belgian coast during the War, and every call on the engines was answered. Her performances were considered remarkable, and she is now a training ship for oil engineers for the British Fleet.

Up to date Messrs. Vickers, Ltd., and their licensees have manufactured internal combustion engines, fitted with their patent system of mechanical spraying, to a total horse power of 500,000, the diameters of cylinders ranging from 10¾ in. to 30 in. Almost the whole of these engines have been supplied to the orders of the British Government. Such contracts cannot be given publicity and this perhaps explains why the Vickers system of internal combustion engines is not so well known to the commercial world as it is to the naval engineering expert.

PERFECTING THE DIESEL AIR COMPRESSOR.

In recent articles on motor shipbuilding in these pages reference has been made to troubles experienced with marine Diesel air compressors. The North-East Coast Institution of Engineers and Shipbuilders in Scotland have been considering the problems involved, and recommendations are offered affording a partial, if not an entire, solution.

In nearly all cases a Diesel compressor is provided with sufficient capacity to charge the starting-air bottles as well as to provide the requisite quantity of blast air, and it frequently happens that the compressor is not designed from the point of view of the work it will be expected to perform during the greater part of its life. It has also been noticed that when a firm specialising in compressors is asked to supply a machine for coupling to a Diesel engine, the only items generally specified are the maximum output required in free air per minute (which is fixed so as to ensure a good margin), the revolutions of the compressor, and the maximum working pressure. No mention is made of the volume of air which will ordinarily be necessary for blast purposes. In consequence of this, the compressor is designed for the full output, whereas most of its time it will be running at a reduced output for supplying blast air only.

As an example, let it be assumed that a three-stage compressor is designed so that the theoretical final temperature is the same in each stage. If the clearance volumes in the first, second, and third stages are taken as 4 per cent., 4 per cent. and 5 per cent. respectively, and it is assumed that the air-suction temperature is 70 deg. F., and that it is cooled to 70 deg. F. between the stages, the temperature at the end of each stage, obtained from theoretical diagrams, would be about 280 deg. F. for a final pressure of 900 lbs. per sq. in. If the compressor supplies blast air only, which is assumed to be seven-tenths of the full output, the maximum theoretical temperature will rise to 336 deg. F. owing to the increased ratio of compression. When supplying blast air only under working conditions, with tight valves, temperatures higher than 336 deg. F. would be reached on account of the increase in pressure necessary to cause the flow of air and to overcome the frictional resistance of valves and passages, dependent on the capacities of the intercoolers and on the arrangement of the stages. Further, it is also probable that after the first stage the initial temperatures of the second and third stages would be higher than 70 deg. F. There is no doubt that in certain circumstances very high final temperatures are obtained, and small explosions in pipes, etc., which have affected the good working of the valves, have not been exceptional.

From the point of view of maximum air temperatures, therefore, it is considered preferable to fix the staging so as to get the minimum stage temperatures when the compressor is supplying blast air only. As an alternative, should the general arrangement of the machinery permit of this, a four-stage compressor could be fitted. In the alternative scheme the first stage would be of sufficient capacity to give the full output required for charging the starting-air bottles and providing the blast air, and the second stage would be of sufficient capacity for providing blast air only with a small margin. When charging starting bottles all stages would be in use, and there would be four stages of compression, but when providing blast air only the first stage would be cut out entirely and the second, third, and fourth stages would operate as a three-stage compressor—the second stage then taking its suction from the atmosphere. The dimensions of the third and fourth stages would be fixed so as to give the minimum final temperatures in the second, third, and fourth stages when supplying blast air only.

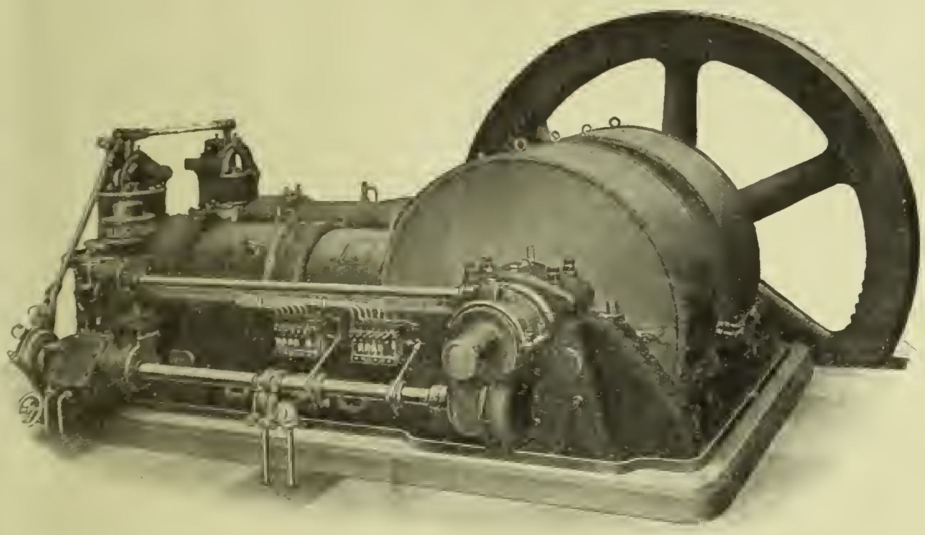
With the four-stage proposal, when supplying blast air only, the second stage virtually becomes the first stage of a three-stage compressor, and it is pumping at practically its full output. The difference in volume between the first and second stages would, of course, depend on the extra output required for charging starting-air bottles. In the case of a compressor attached to a two-stroke engine, when the scavenging pressure is from 3 to 4 lbs. per sq. in. a three-stage compressor could be fitted, and arrangements made so that when charging starting-air bottles the first stage would take its suction from the scavenge air supply instead of the atmosphere—which is equivalent to the four-stage proposal outlined.

An excess of lubricating oil in the compressor cylinders, combined with the comparatively high temperatures referred to above, is another frequent source of trouble. In cases where the first-stage cylinder is open to the crank case it is considered that better results would be obtained by:—(1) Removing the throttle from the first-stage suction; (2) fitting a drain bottle between the first-stage cooler and second-stage suction; (3) fitting an overflow valve to the drain bottle; (4) fitting to the first-stage piston a suitable guard with a drain, so that the lubricating oil from the gudgeon pin falls clear of the compressor cylinder. More effective guards considerably reduce the quantity of lubricating oil passing from the crank case into the compressor cylinders. Compressors for Diesel engines might well be treated with the great care taken with high-speed reciprocating steam engines fitted with forced lubrication to prevent oil finding its way into the cylinders.

TEST OF "RUSTON" TWIN OIL ENGINE.

Very convincing evidence of the high degree of economy and efficiency obtainable to-day in the oil engine of British manufacture is contained in the results of a recent test of a double-cylinder engine by Messrs. Ruston and Hornsby, Ltd., of Lincoln, particulars of which the makers have been good enough to forward. An illustration of the actual engine tested accompanies this article; another view of a smaller single-cylinder engine of the same type is also given. These engines are cold starting, and have airless injection.

As will be seen, the engine tested was of the horizontal type, having two side-by-side cylinders, firing alternatively, and cranks at 0°. The flywheel was on one side of the engine, and the load was applied by a Heenan and Froude brake bolted to the flywheel boss. The particulars of the engine are:—Cylinder diameter, 18½ in.; stroke, 30 in.; r.p.m., 175; rated b.h.p., 260. This type of engine works on a four-stroke cycle. During the out-stroke following the exhaust of the products of combustion, pure air is drawn in and then compressed to about 450 lbs. per sq. in. during the following in-stroke. The compression temperature is amply sufficient to ignite the oil, which is forced into the cylinder at about the turn of the stroke by an oil pump, giving an adequate pressure to atomise the oil. Owing to the high compression temperature, preheating of a hot bulb is unnecessary, and the engine can therefore start from cold. The combustion is therefore partly at constant volume and partly at constant pressure, which is thermodynamically somewhat more efficient than combustion at constant pressure.

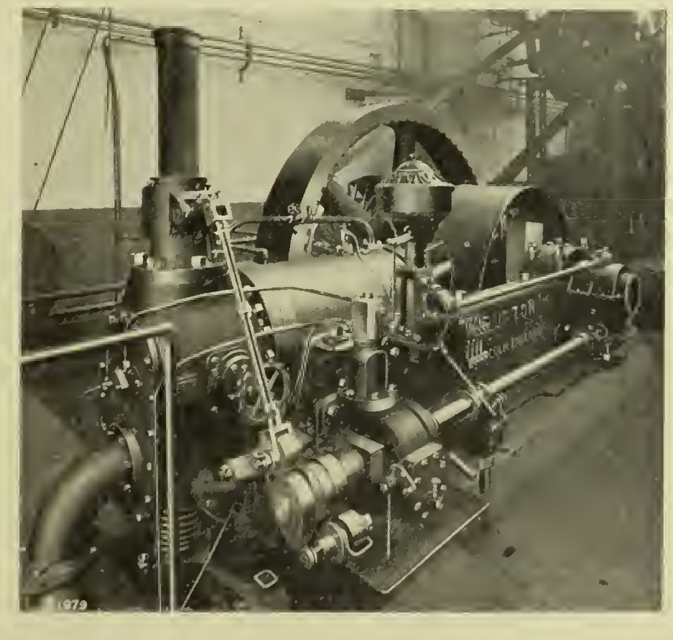


The "Ruston" Twin Oil Engine tested by Capt. Sankey.

The test was carried out by Capt. H. Riall Sankey, C.B., C.B.E., M.Inst.C.E., and the object was to ascertain the oil consumption per b.h.p. at various loads. The method of testing was that in current use at Messrs Ruston and Hornsby's works, and all measurements were taken by their staff under Capt. Riall Sankey's supervision.

As already stated, the load was applied by means of a Heenan and Froude hydraulic brake. The weights used with this brake were compared with standard weights and found to be accurate. The oil consumption of each cylinder was measured separately by arranging so that the oil surface in the supply tank broke away from a needle point at the moment of starting the test for each load, and, similarly, at the moment of completing each half-hour's run, and then obtaining the weight of oil thus required by the difference in weight between the full and partially emptied can used for pouring the oil into the tank The weights used for weighing the oil were checked against standard weights and were found to be correct and well within the limits of the errors of the test. The balance used turned with 1-8th of an ounce. The speed was obtained by readings of a revolution counter taken every quarter of an hour. Indicator diagrams were taken simultaneously from each cylinder every quarter of an hour. Three samples of oil were taken, one from each of the barrels used, and the calorific value was subsequently determined by independent authority, which showed that the calorific value of all three samples was the same, namely, 19,260 B.Th.U. per lb. higher calorific value. The lower calorific value, which is the value to take in accordance with the rules of the Institution of Civil Engineers, works out to 18.051 B.Th.U., assuming 13.9 per cent. of hydrogen.

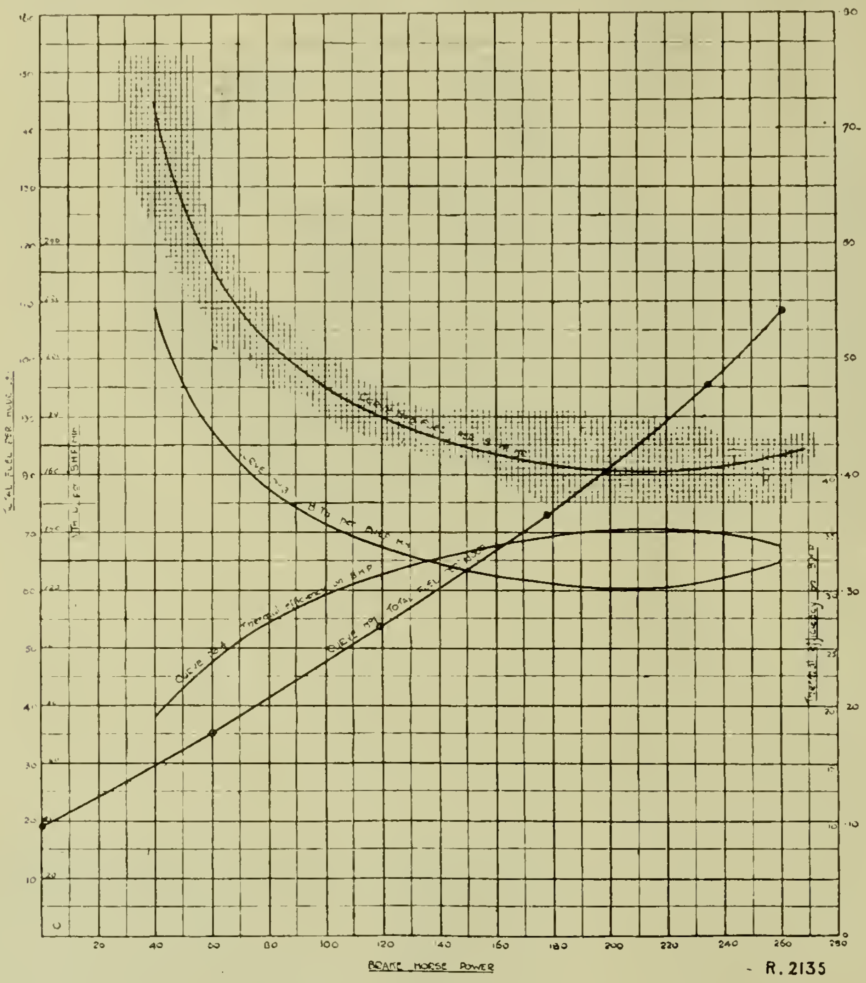
The engine was started at 8 o'clock, and ran at about half load until 9.10 o'clock, when full load was applied. The full load test began at 9.20 o'clock, and continued for three hours. The load was then quickly lessened to three-quarter load, which was maintained for one hour, after which the load was reduced in succession to half load and quarter load each for one hour, after which the engine was run with no load for half an hour, then an overload approximately of 10 per cent. was applied for half an hour. Lastly, the quarter load test was repeated for half an hour, and the trial ended at 6 p.m.



"Ruston" 72 - B.H.P. Airless Injection Engine running regularly on a low grade Furnace Oil containing a high percentage of Creosote.

The results of the test are shown in the consumption and efficiency curves given. In these curves the total average oil consumed per hour is plotted on a b.h.p. base, and a fair line is drawn through the plotted points giving curve No. 1. It will be seen that the centre portion is almost quite straight, following the Willans law. Both at the full load end and at the no load end the line curves slightly upwards. By thus drawing a fair line through the plottings of the observed points, the tests at the various loads are connected together, errors are adjusted, and the final result obtained is more reliable than by plotting the oil consumption per b.h.p. hour. Curve No. 2 shows the oil consumption per b.h.p. hour, and has been obtained by calculation from curve No. 1. The minimum consumption is at 235 b.h.p., and is 0.401 lb. per b.h.p. hour. Curve No. 3 shows the economy of the engine expressed in B.Th.U. per b.h.p. per minute, giving the low figure of 120.7, and Curve No. 4 the thermal efficiency reckoned on the b.h.p. The highest figure is 35.1 per cent. It was considered unnecessary to obtain the i.h.p. from the indicator diagrams.

Capt. Sankey adds that the action of the governor was observed during the trials, especially when changing load. The variation of speed was very small, and even with rapid changes of load there was no hunting. Throughout the trial the engine ran remarkably well, and so uniformly that it was impossible to tell by sound what load was on the engine and when such load was changed.



Consumption and Efficiency Curves, "Ruston" Twin Oil Engine Test.

DESTRUCTION OF TAPPED SURFACE IN RUBBER TREES.

The mycologists to the Federated Malay States Rubber Growers' Association, Messrs. Sanderson and Sutcliffe, have issued, in "Annals of Applied Botany," details of what is, relatively, a new disease affecting the rubber tree (*Hevea brasiliensis*). The disease is Sphæronema sp., and consists in the mouldy rot of the tapped surface. The fungus destroys the thin skin of cortex remaining after tapping, delaying renewal of the cortex and making it almost or quite impossible for tapping to be carried on over that section again.

The disease was originally confused with another well-known and widespread disease of the tapped surface, viz., black thread or black line canker, the causal fungus of which is a series of Phytophthora, mouldy rot being considered a virulent form of this.

The causative fungus of the new disease is a species of Sphæronema which belongs to the group *Fungi Imperfecti*. Investigation of inoculations shows that in 48 hours all the inoculated surfaces had become discoloured, turning a dirty brown, and by the end of the fifth day the cells of the outer surfaces had been completely killed.

Deep tapping undoubtedly aids in the thorough establishing of the fungus in the tissues, since under those conditions penetration to the wood is quickly effected. Much wounding during tapping also aids in a similar way.

A freshly-exposed surface of Hevea attacked by Spæronema turns darker in colour than normal in quite a short time (24 hours). In three days the infected surface rots, and various pieces of saprophytic fungi make their appearance on the dead tissue, the presence of these being indicated by the tell-tale more or less complete cover of white mycelium. This appearance is most noticeable 1 to 2 in. above the cut. Portions of the tapped cortex sink in, forming depressed patches of various sizes, which may in a bad case extend the whole length of the cut. The affected portion frequently turns quite black. Later, in neglected cases, the fungus penetrates the wood 1-12th to 1-8th in., spreading vertically up and down the wood fibres.

The damage caused by this disease when neglected is probably greater than that due to any other bark disease of Hevea. The disease continues as long as tapping is continued, and is easily spread from tree to tree by the knife.

Cortex destroyed by the disease is frequented by small Diptera and beetles, both of which are liable to spread the disease, especially by carrying the pycnidiospores, which adhere to the legs and bodies.

Since the fungus quickly produces spores (five - six days), once a tree is attacked and the initial attack overlooked, the spread of the disease is usually very rapid, and whole groups of 300-400 trees may be affected in the course of a week or fortnight.

The loss sustained by an estate affected by mouldy rot, unless efforts are at once made to obtain control and eradicate the pest, may be very great, as once it becomes fairly widespread tapping must be stopped for periods varying from two to six months, and this may have to be repeated after re-opening if the disease shows signs of reappearing. The distribution of remaining cortex after tapping also is bound to be serious if it continues for any length of time, since a shortage of bark means loss of revenue.

As evidence of the good progress in mercantile ship construction being made at their Southampton works Messrs. John I. Thornycroft & Co., Ltd., send us particulars of their fourth cargo steamer built during the past half-year. This has been constructed to the smallest of the three standard designs of mercantile vessels the firm is now constructing, to carry 4,300, 2,000 and 550 tons respectively.

The main engines are of triple expansion type, with diameters of 13½ in. h.p., 22 in. i.p., and 35 in. l.p. by 27 in. stroke. The working pressure is 180 lb. per square inch, giving 500 i.h.p. at 120 revolutions per minute. The cooling surface of the condenser is 610 sq. ft. One return tube type boiler is installed with Howden's forced draught, size 11 ft. 6 in. in length by 13 ft. diameter, with a heating surface of 1,832 sq. ft.; grate area of 51½ in. sq. ft. Three watertight bulkheads are fitted, one at each end of the machinery space and one at fore end of cargo space. Speed, 9½ knots; length, overall, 162 ft.; ditto, b.p., 155 ft.; breadth moulded, 26 ft.; depth moulded, 12 ft. 6 in.; draught loaded, 12 ft.

Mr. J. M. Falkner, acting upon medical advice, has resigned his position as chairman of the board of Sir W. G. Armstrong, Whitworth and Co., Ltd. The directors have elected Sir Glynn H. West to the vacancy. Sir Glynn H. West has been vice-chairman of the firm. Mr. J. M. Falkner had been chairman since 1915, when he succeeded the late Sir Andrew Noble.

A NEW HOSE COUPLING.

Flexible hose is now universally used for hydraulic and pneumatic purposes, and also for the conveyance of oil and other liquids under pressure. Whether the hose be of rubber or metal, the matter of coupling the various sections has been a necessary evil, and the troubles experienced with them have been legion. It has been asserted that more money is wasted due to leakage at joints than in any other direction.

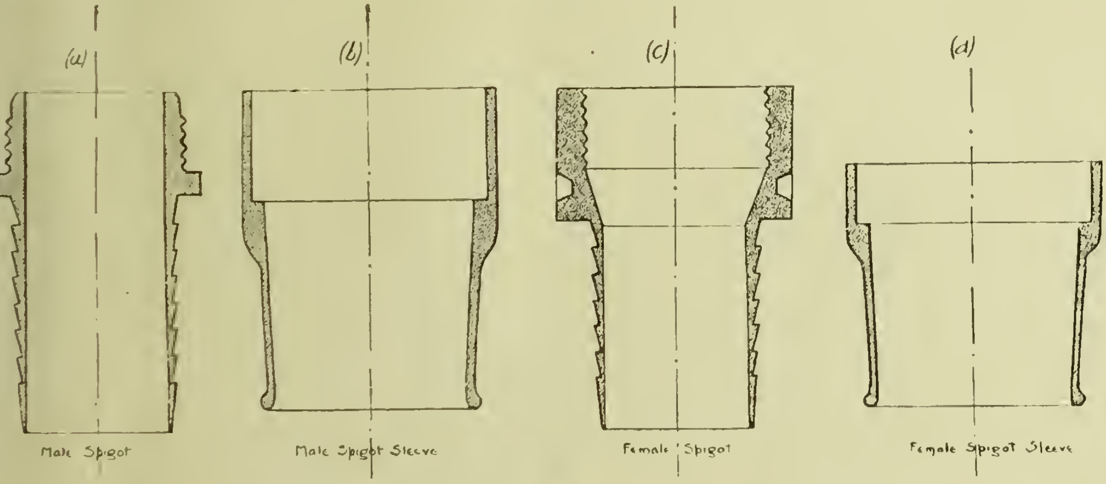
The new coupling dealt with here is manufactured by the Consolidated Pneumatic Tool Co., Ltd. (London). Not only is it simple, but exhaustive tests have shown that it is leakage proof under high pressures. A glance at the sketches reproduced here will show not only how the coupling is formed, but also the simplicity and rapidity with which the joint can be made.

Some essential features which will appeal to users are: (1) There are no loose parts to get lost; (2) no spanners or other tools are required to make the coupling; (3) the coupling, being metal to metal, is not dependent upon leather or rubber washers for tightness.

The coupling is made in four parts, as follows:—(a) Male spigot; (b) male spigot sleeve; (c) female spigot; (d) female spigot sleeve. The spigots are designed so that on insertion into the bore the hose is swelled out. The sleeves (b and d), on being drawn up into position, press the rubber tightly into the serrations on the spigots. It is impossible for the hose to pull or blow off.

It should be particularly noticed that the cone face on the end of the male spigot is protected at all times by the sleeve (b), which is designed to act as a shroud.

The couplings and hose accessories have been designed and used for all sizes and varieties of rubber and metallic hose.



JAPANESE OIL MONOPOLY.

A report from the United States Commerce Bureau refers to the decision at Tokyo that no proposal looking toward a Government monopoly of petroleum will be made until Parliament convenes in January. While nothing definite has been decided upon, the proposed monopoly is likely to affect all Japanese possessions as well as the oil-fields in Japan proper.

Japan produced only about one-half of 1 per cent. of the world's crude petroleum in 1919, and its production has shown a steady decline since 1916, when 123,558,416 gallons were produced. The production for 1917 dropped to 119,576,223 gallons, and that for 1918 to 102,110,650 gallons. The figures for the full year 1919 are not yet available, but basing estimates on the first nine months' production of 67,737,796 gallons, the total production for 1919 will not reach much more than 90,000,000 gallons.

The oil monopoly is being proposed largely in order to guarantee supplies for the Navy, and new wells have been bored at Nairya and Kosenho, in Formosa, with rather indifferent results. The Echigo fields, which produce about 60 per cent. of Japan's supply, showed a decline of about 10 per cent. in production during 1919. Decline in production is attributed somewhat to increased difficulty of importing well-boring apparatus since the Armistice, and this has undoubtedly impeded the development of new resources.

The decline in production of crude oil has been accompanied by a growing demand for benzine, the output increasing from 240,000 cases in 1914 to 1,000,000 cases in 1919. Notwithstanding this increased output, the consumption exceeds the domestic supply of benzine by about 20 per cent., and the imports have increased from 178,000 cases in 1914 to 266,000 cases in 1919, principally due to the automobile consumption. This condition has been reflected in the prices of gasoline, which have practically doubled since 1914. The 1914 price of 45 cents to 50 cents per gallon rose in November, 1919, to 86 cents per gallon, and $1 per gallon was paid for gasoline in some cities toward the close of 1919. In February ,1920, the price had receded to 80 cents per gallon. The effect of monopolisation on prices will be an interesting development.

NORTH-EASTERN MARINE ENGINEERING CO., LTD.

OUTPUT FOR 1920.

The North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne and Sunderland, forward us particulars of their output for 1920. These show that no fewer than forty-two vessels, aggregating 90,770 i.h.p., were fitted by the firm with machinery and boilers, including two vessels, totalling 6,450 i.h.p., fitted with geared turbines supplied by Parsons Marine Steam Turbine Co., Ltd. Nine vessels, aggregating 5,802 i.h.p., were fitted with new boilers only. These figures give a total output for the year of 96,572 i.h.p., which compares with 69,935 in 1919, 118,234 in 1918, the year the war ended, when shipbuilding and marine engineering were being conducted under abnormal pressure, 79,935 in 1917, and 52,165 in 1916. The five years' average is 83,368 i.h.p., a figure well exceeded by the output for the twelve months now drawing to a close.

In their superheating department the firm during 1920 manufactured and fitted "North-Eastern" smoke tube superheaters, which were described in these pages some little time back, to thirty-one vessels, totalling 117,300 h.p.

THE accounts of Vickers, Ltd., have been published for the four years 1916, 1917, 1918 and 1919, dealt with as one period. So far as the profits are concerned, they amounted in the four years to £4,493,725, to which had to be added £319,749 brought forward. The dividend for the four years absorbed £3,967,112, leaving a balance of £846,363, after providing for all Government taxation. The following figures show the position at the date of the previous balance-sheet compared with the figures just published:—

	Dec. 31, 1915.	Dec. 31, 1919.
Share capital	£7,049,784	£20,662,188
Debenture stock	2 315,528	1,252,972
Creditors	11,766,436	13,084,862
Reserves	2,064,261	6,669,159
Properties and plant ...	5,724,486	7,314,094
Subsidiary undertakings...	5,448,734	17,236,516
Marketable securities ...	916,159	732,748
Stocks, etc.	785,002	3,911,684
Book debts	10,213,639	9,959,543
Cash and bills	825,426	3,361,957

The growth in the reserve is a very satisfactory element, and a reduction in the debenture debt is also a favourable feature. Special interest attaches to the great increase in the item for subsidiary undertakings. Difficulties in conducting certain of these successfully have been experienced.

MODERN ENGINEERING PRACTICE.

DETERIORATION OF NICKEL RESISTERS.

Evidence submitted to the American Electro-Chemical Society at Cleveland by the Fitzgerald Laboratories shows that, under certain precautions, pure nickel wire is applicable as a substitute for the nichrome alloy now much used. This alloy is expensive, and certain onerous conditions are attached to a licence for its use. Nickel has a high thermal co-efficient of electric resistance, and a liability to oxidation, but it was thought that those disadvantages could be overcome. Tests, however, showed early deterioration, by the wire becoming brittle, although no marked oxidation had occurred. It was thought at first that the result was due to absorption of carbon, as the insulating material was infusiorial earth and a refractory cement, both of which contained organic matter. Some of the brittle wire was tested by being heated in a current of oxygen, and it was found that the emitted gas produced a precipitate of barium carbonate. The inference, however, was not correct, and details are given in the original record of experiments by which it was proved that combination with sulphur is the cause of deterioration. From the experiments it appears that sulphur makes nickel brittle at low temperatures; and nichrome wire is also affected by sulphur, but less markedly. Wire rendered brittle by sulphur can be softened by heating in a current of oxygen. Pure nickel seems to stand up well as a resister when not exposed to contamination with sulphur.

ELECTRO—PERCUSSIVE WELDING.

Modern practice in electro-percussive welding was discussed at a recent meeting of the American Welding Society. This form of welding is a process which is primarily intended for manufacturing applications where large quantities of duplicate parts are to be produced. The apparatus in its earlier form consisted essentially of a device for producing a percussive engagement of parts to be welded, practically simultaneous with a discharge of electrical energy from an electrolytic condenser consisting of aluminium plates immersed in an electrolyte of borax solution charged by a direct current of very small value, and discharged at the moment of weld. A scheme has now been evolved for utilising electrical energy stored in a magnetic field, thus substituting electro-magnetic energy for electro-static, and welds of the butt type up to a cross-sectional area equivalent to ½ in. diameter stock have been successfully made. The complete operation occupies about 0.1 second of time, giving no time for oxidation or excessive heating. The time sequence of events shown in an oscillogram taken during a weld between ⅜-in. copper and steel rod indicates a peak of current of 2,600 amp., an arc voltage of 30, maximum power 60 kw., energy 0.000.77 kw.-hr., and time 0.094 seconds.

THE ACTION OF SOLID LUBRICANTS.

The virtue in the employment of a solid lubricant, such as flake or amorphous graphite, mica, or flower of sulphur, or colloidal lubricants, lies entirely in the effect it produces on the rubbing surfaces. According to a memorandum issued by the Department of Scientific and Industrial Research in London, it has been noticed that immediately after a temporary application of a solid lubricant in powder form the friction is much increased, but it is reduced afterwards, when the particles have had time to attach themselves to the rubbing surfaces and to form a smooth coating. All metallic surfaces, even when machined and well polished, are more or less rough, and on rubbing tend to abrade, the softer surface being more rapidly abraded than the harder, except when hard particles become embedded in the softer surface. On introducing a solid lubricant between otherwise unlubricated surfaces, the finely divided particles of the lubricant associate themselves with one or other of the rubbing surfaces, filling in the pores or depressions, and acting to some extent as a smoothing and polishing agent. The co-efficient of friction corresponding to rubbing action between two unlubricated metallic surfaces normally ranges from 0.10 to 0.40. On introducing a solid lubricant this co-efficient is reduced, and the solid friction between the more or less rough original rubbing surfaces is replaced by the smaller friction between the smooth surfaces formed by the solid lubricant. Abrasion, then, takes place between the particles of the solid lubricant (which have but little cohesion) and not so much between the original surfaces. Solid lubricants are advantageously applied in bearings or in such parts of machinery as are apt to be neglected from a lubricating point of view, and which operate at low pressures and low speeds. With perfectly lubricated bearings the chief advantage of solid lubricants is apparently the effect of the friction at the moment of starting and at very low speeds, which results in a reduction of the static coefficient of friction, and prevents the surfaces from injuring each other until the lubricating film forms. In the case of oil-lubricated surfaces (viscous friction) the effect, after a period of rest, is that the oil film is, more or less, completely squeezed out, and a certain amount of solid contact takes place. As a result the starting effort is much greater than the running effort; in fact, the static coefficient approximates to the values applying to dry (unlubricated surfaces) friction. As a solid lubricant cannot be displaced by pressure, the static coefficient is reduced as compared with the result when oil alone is used—assuming, of course, that the solid lubricant is of such a nature and used in such a manner that it has actually increased the smoothness of the rubbing surfaces. The difficulties connected with the starting of engines or machinery from rest have led to the use of ball and roller bearings, and with surfaces in rolling contact there is practically no difference between static and kinetic friction. The great majority of bearings are not steam fed, but are only supplied with a limited quantity of oil per unit of time. The result is that the surfaces are only imperfectly or semi-lubricated, the coefficient of friction ranging from 0.01 to 0.1 (with perfectly oil lubricated surfaces it varies from 0.002 to 0.01). In such cases solid lubricants should prove of undoubted advantage.

PROTECTION AGAINST MACHINERY ACCIDENTS.

In safeguarding the ordinary parts of machines, the following are regarded as the essentials of a satisfactory safeguard:—(1) It should prevent access to the dangerous part so long as the danger exists; (2) it should be constructed of such materials and in such a manner as to withstand the wear and tear to which it is likely to be subjected; (3) wherever practicable it should form an integral part of the machine, and have been considered in its design; (4) it should, where necessary for intermittent dangers, be automatic in action; (5) its removal should not be necessary for the purpose of lubricating parts of the machine or the material under operation, or for changing belts, gears, etc.; (6) it should not introduce any fresh risk of accident; (7) it should be so hinged or hung as to be easily opened or removed when frequent adjustments and alterations are necessary, but in such cases should not be easily removable from the immediate neighbourhood of the machine; (8) it should not interfere unduly with the output of the machine. Wood, cast iron, sheet metal rods, tubes and bars of metal, wire-work and expanding metal, millboard and papier maché may all be utilised, and may all prove satisfactory under particular circumstances. When substantially and firmly constructed of sound timber, wooden guards for such parts of machinery as pulleys, belts, small flywheels, and shafting, can be both neat and effective. The use of wood for guards has, however, many disadvantages; it is easily splintered and broken, readily absorbs liquids, and increases the fire risk. The following are the principal accident-producing parts of machinery or machines in engineering works:—(1) Plain shafting, spindles, etc., bars and rods in automatic lathes; (2) projections, such as set screws, studs, bolts, key heads on collars, couplings, clutches, pulleys, etc., lathe carriers, drivers and jaws of chucks; (3) flywheels, armed pulleys and wheels; (4) driving belts, ropes and chains; (5) spur and friction gearing; (6) revolving cutting tools; (7) grindstones and abrasive wheels (bursts); (8) sliding and reciprocating parts, including plungers of presses, punches, etc.; (9) hoists and lifting appliances, cranes, etc. This list is not exhaustive, but it shows the principal sources of machinery accidents where safeguards can be adopted with advantage.

POWER ALCOHOL FROM FERMENTABLE SUGAR.

Increased attention is being given to the question of production, on sugar plantations, of alcohol for power and lighting purposes. On one estate alcohol made on the spot and denatured under fiscal supervision costs no more than 8d. per gallon. In Hawaii it is announced that a denatured alcohol plant is to be erected on a plantation, which will at the start produce 300 gallons daily at a cost of not more than 10d. per gallon and make the plantation independent of imported gasolene. The average cost of producing 95 per cent. alcohol is put by one authority at no more than 9d. per gallon, including cost of depreciation of plant. These pries should stimulate effort towards a wider and larger production of this source of power, even if it be the case that local consumption only is supplied. It is satisfactory to note that modern practice in the construction and management of internal combustion engines is rapidly adapting itself to the more general employment of power alcohol. Without doubt a very wide market for this source of power can be easily and rapidly developed.

BOOKS.

ENGINEERING FOR LAND DRAINAGE.

By Charles Gleason Elliott, M.Assoc.S.C.E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 13s. 6d. net.

This is a manual for the reclamation of lands injured by water. In Chapter IV. the author describes drainage as the removal of surplus water from the soil, whether accomplished by nature or by channels artificially constructed. Surplus water is the excess above that needed from day to day for the use of plants and that stored in the lower strata of the earth as a reservoir supply during times of drought. From this definition it will be seen how wide and important a field the work covers. It deals moreover, with a field which specially awaits attention in the Far East. The author has wisely kept the book very largely free from technical matters. Drainage problems are considered not only by engineers but also by corporations, boards of commissioners, drainage associations, private individuals and others. If therefore a book is to be of value to all concerned, as this book certainly is, the matter must be divested as far as possible of technical details. Like other branches of engineering, drainage engineering calls for mechanical skill, but this section of the subject is only briefly treated in the volume under review. Chapter I. deals with the development of land drainage, and in this section the author pays generous admission to what the world owes to British experience and methods. The qualifications and duties of the drainage engineer are then defined. Chapter III. treats of engineering technique, such as levelling, stadia work, compass work, and fieldwork generally. In the section on " Drainage and how accomplished " the subject is generally handled, the various sections being treated in detail in succeeding chapters on the preliminary survey; under drains and their location; flow in under drains; the run-off from underground areas; size, selection and construction of tile drains; flow in open channels; the run-off from large areas; location and construction of open ditches; levee drainage systems to protect interior lands from overflow of streams or coast lands from encroachment by the sea. Chapters are also given to reclamation of tidal lands, drainage of irrigated lands and of peat and muck lands; control of hill waters, etc. Many useful records and tables are appended. The work is in its third edition, in which some parts have been revised and others added. The discussion of the hydraulics of flow in under drains has been rewritten and new tables for the discharge of tile drains have been introduced. A diagram to facilitate the application of Kutter's formula in the design of ditches and canals has been added, with a more complete text on drainage by pumps and on drainage of irrigated lands. The book is recommended not only to students and engineers, but to all who are concerned with the drainage of land. Its perusal, moreover, is well calculated to promote a class of project most beneficial to humanity.

WELL-BORING FOR WATER, BRINE AND OIL.

By C. Isler. London: E. & F. N. Spon, Ltd. 16s. net.

The name of the author is sufficient recommendation as to the practical character of this work, a recommendation which the perusal of the volume shows to be well founded. The book is now in its third edition, which embodies the latest methods in well-boring which have been developed during recent years. Not only will the book prove particularly useful to the pioneer and those engaged in the development of new lands in all parts of the world, but it should be of value to industrial circles requiring a constant and economical supply of pure water. The book is primarily intended to describe various methods of boring and drilling, and it clearly demonstrates the importance, safety and economy of the deep well, the shallow well having been largely abandoned. Special attention is drawn to the recent method of combined steel shot and percussion boring. With recent improvements in this system the hardest rocks can be penetrated with ease and accuracy, and as rapidly if not more so than by the diamond drill. Attention is also drawn to the important method of lining bore-holes advocated by the author. Various means of raising water by wells, bore-holes, deep-well pumps surface pumps, etc., are dealt with, and special attention is devoted to raising water by means of compressed air. Separate chapters are given to dug wells, driven and bored tube wells, Kind-Chandron, Dru, and Mather & Platt deep-boring systems and to American rope-borings also to deep boring with diamond drills. The information conveyed is, with the exception of the last chapter, equally applicable to any country of the world and forms a manual of current practice, which should prove of great value in the Far East, with its special problems of water supply.

SLIDE RULES AND HOW TO USE THEM.

By Thos. Jackson, M.I.Mech.E. London: Chapman & Hall, Ltd. 1s. 6d. net.

As this little work sets out, one of the most striking developments in modern technical methods of calculation has been the great increase in the use of slide rules. But while there is a very general recognition of the utility of these time-saving inventions, the knowledge of how such utility may be secured is by no means so general, and the instruments varied uses are often limited to little more than simple multiplication and division. The booklet states the calculations possible and the methods by which the results are obtained. It deals not only with the common form of rule, but also with many of the special rules now obtainable, pointing out the advantages gained by the arrangements adopted compared with the ordinary rule. The "Fox," "Rietz," Bentley Long-short," and "Omnes" rules are amongst those so treated. The "Boucher" watch-form calculator or "Calculigraphe," is also treated in the appendix. The book is written in a clear and concise fashion, and its study is to be recommended to users of what the author describes as that "wonderfully perfect instrument"—the modern slide rule.

HYDRAULIC TABLES.

By Gardner S. Williams, M.Assoc.S.C.E., and Allen Hazen, M.Assoc.S.C.E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 10s. 6d. net.

This work, now in its third edition, gives the elements, comprising explanatory text and tables, of gaugings and the friction of water flowing in pipes, aqueducts, sewers, etc., as determined by the Hazen and Williams formula and the flow of water over sharp-edged and irregular weirs, and the quantity discharged as determined by Bazin's formula and experimental investigations upon large models. In the present edition a new chapter has been added as a brief statement of how the old procedure for pipe flows fits with the numerous new methods now available. A plate has also been included to show geographically the relations of the most important results both new and old.

PERSONALIA.

Estate of the value of £405,840, of which £394,896 is net personalty, has been left by the Right Hon. Sir William Mather, D.L., chairman of Messrs Mather & Platt, engineers, of Salford, vice-president of the British Cotton Growing Association.

The death is announced of the Earl of Bessborough, chairman of Guest, Keen & Nettlefolds, Ltd., of Birmingham. Mr. Edward Steer, deputy-chairman of the company, has been elected chairman of the board, in succession.

H.M. Commercial Agent for the Netherland East Indies, Lieut. H. A. N. Bluett, whose appointment was recently announced, is shortly leaving England to take up his position at Batavia.

Mr. C. H. Wilson, who has been for many years connected with John Spencer & Sons, Ltd., Newburn Steel Works, Newcastle-on-Tyne, has been elected a director of the company.

Mr. James Weir, father of Lord Weir, and of the firm of J. & G. Weir, engineers, Glasgow, left estate valued at £684,596.

Mr. S. Young has resigned his position as a director of Head, Wrightson & Co., Ltd., in consequence of ill-health.

Mr. A. J. Dishman, A.I.M.M., has left London on his return to the Federated Malay States.

Mr. W. Brown, A.I.M.M., has left London on his return to the Straits Settlements.

Mr. W. C. Braddon, A.I.M.M., has left for the Federated Malay States.

Mr. J. T. Bagram, A.R.S.M., has left for China.

TRADE NOTES.

The accounts of Dorman, Long & Co., Ltd., the structural engineers, of Middlesbrough, for the year ended September last, show total profits, after allowing for estimated liabilities to the Government, of £743,100, an advance of £231,000 on a year ago. Dividend on the ordinary shares, including new capital, is 10 per cent.; £21,000 is applied to debenture redemption, and £200,000 to general reserve, £248,500 being carried forward. The company has acquired the shares of the Carlton Iron Co., Ltd., except a very small number. The blast-furnaces at Carlton will afford a supply of ferro-manganese.

The accounts of Head, Wrightson & Co., Ltd., the structural engineers, of Stockton-on-Tees, show:—Profit, £78,917; brought forward, £19,623; interest on debentures, £6,750; dividend on preference shares, £9,302; directors' fees, £1,000; reserve account, £37,000; reserve for pension scheme, £3,000; interim ordinary dividend, 5 per cent., £10,500; reserved for preference dividend, £845; final ordinary dividend, 5 per cent. (making a total of 10 per cent.), less tax, £10,500; carried forward, £19,642.

THE directors of Baldwins, Ltd., and the British Mannesmann Tube Co., Ltd., respectively, have entered into a provisional agreement for the purpose of effecting a fusion of interests on the basis of an exchange of shares. The scheme when carried out should effect considerable economies in the operations of both concerns, ensuring to Baldwins an increasing demand for the output of the new Margam steel works and to the British Mannesmann Tube Co. a reliable source of supply of raw material.

THE report and accounts of Herbert Morris, Ltd., of Loughborough, crane and hoist manufacturers, show:—Profit, £121,206; brought forward, £33,355; disposable sum, £163,390; preference dividends for year, £11,438; ordinary dividend for half-year, £6,562; depreciation, £11,288; available, £130,602; final ordinary dividend, 6¼ per cent., making 10 per cent. for year; reserve, £100,000; carried forward, £19,663.

SEVERAL American machine-tool builders met recently to consider the incorporation of a company to handle their export trade. The corporation, it is stated, would be known as the United States Machine Tool Corporation and would maintain direct representation in foreign markets. Member companies would hold stock not to exceed 25 per cent. of the total or less than 5 per cent.

THE business of Casebourne & Co., Ltd., cement manufacturers, has just changed hands. Sir John Hunter, one of the principals of the firm of Sir William Arrol & Co., Ltd., of Glasgow, has acquired the controlling interest.

THE COVENTRY CHAIN CO., LTD., pay 6 per cent. per annum on preference shares for six months ended Aug. 31; on ordinary 7 per cent. per annum, making, with interim dividend of 3 per cent., 10 per cent. for the year, and a bonus of 2½ per cent., all less tax.

THE accounts of the Cleveland Bridge and Engineering Co., Ltd., of Darlington, show:—Profit, £44,519; brought forward, £2,288; final ordinary dividend, 10 per cent., free of tax, making 12½ per cent. for the year; reserve, £10,000; carry forward, £4,008.

ELECTRIC CONSTRUCTION CO., LTD., of Wolverhampton, announce:—Interim preference dividend, 7 per cent. per annum, less tax; interim ordinary dividend, 6 per cent. per annum, less tax.

THE directors of Yates & Thom, Ltd., of Blackburn, recommend an ordinary dividend of 10 per cent. for the year, placing £10,000 to reserve, and carrying forward £10,586.

REES ROTURBO MANUFACTURING CO., LTD., of Wolverhampton, have paid preference dividend of 5 per cent. (3s. per share), less tax, for 1912, 1913 and 1914.

THE directors of the Lancashire Dynamo and Motor Co., Ltd., of Manchester, recommend an interim ordinary dividend of 9d. per £1 share, free of tax.

HOWARD & BULLOUGH, LTD., the textile machinists, of Accrington, declare a quarterly ordinary dividend of 6d. per share (2½ per cent.) actual.

AN interim dividend of 10d. on the fully-paid shares and of 7½d. on the partly paid has been declared by John Brown & Co., Ltd.

THE Chloride Electrical Storage Co., Ltd., of Clifton Junction, Manchester, pay an interim dividend of 5 per cent., free of tax.

THE amalgamation is being negotiated of Elliotts Metal Co., Ltd., and Muntz's Metal Co., Ltd., both of Birmingham.

DAVY BROTHERS, LTD. (SHEFFIELD), are paying an interim ordinary dividend, 2½ per cent. (6d. per share), less tax.

POWER GAS CORPORATION, LTD., of Stockton-on-Tees, recommend a dividend of 8 per cent., less tax, for the year.

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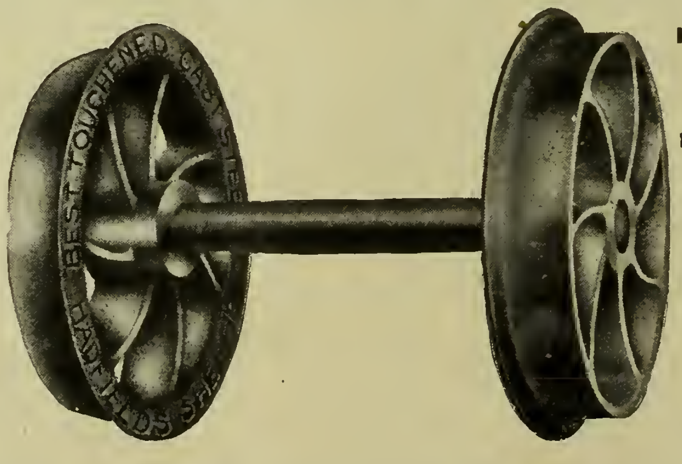

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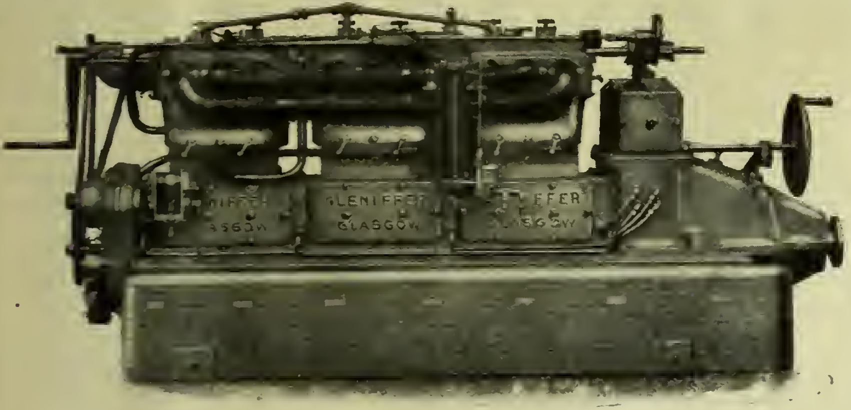

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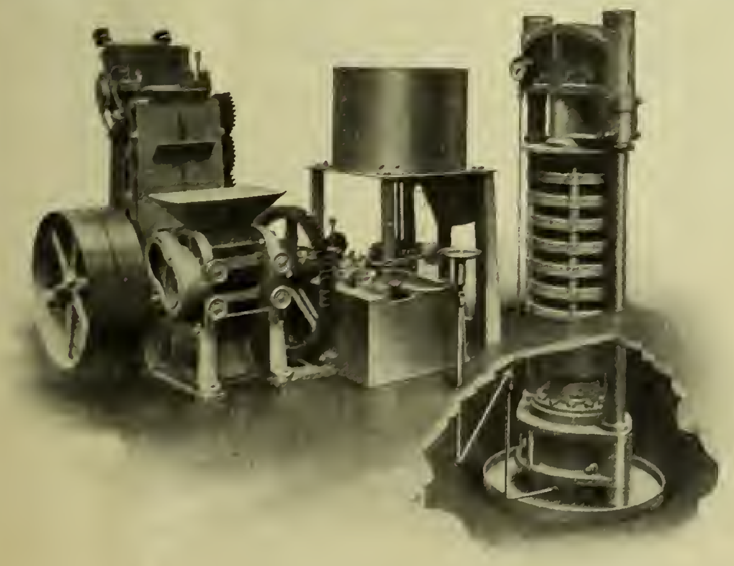

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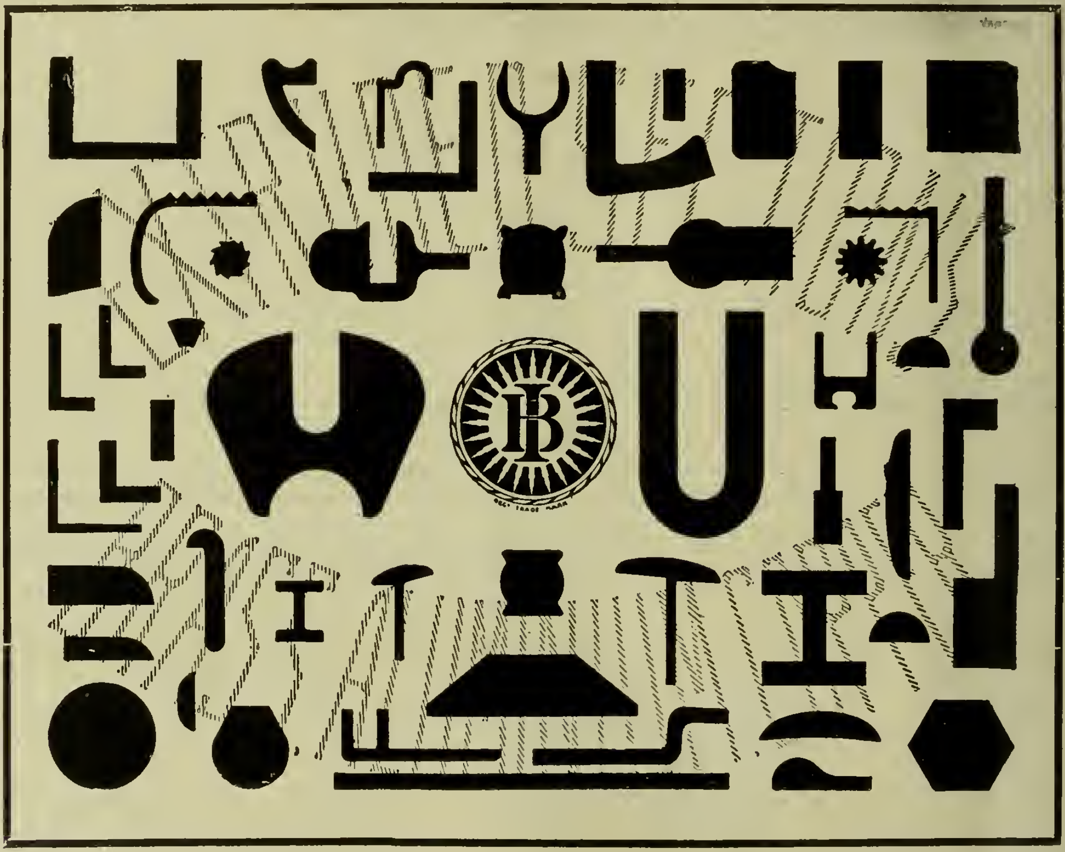

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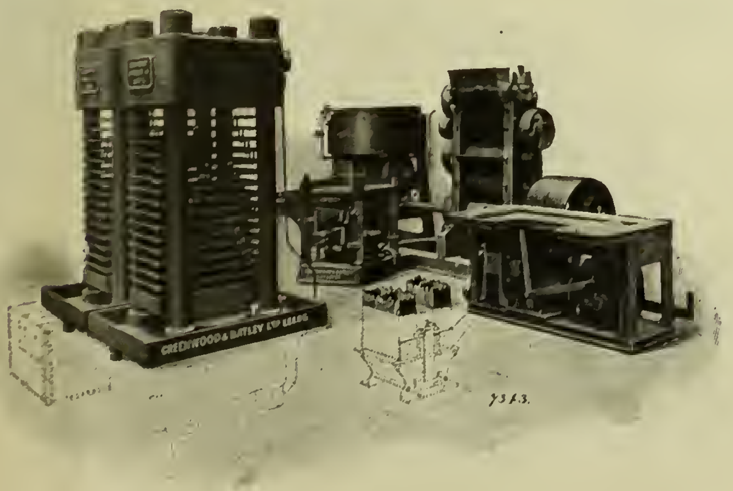

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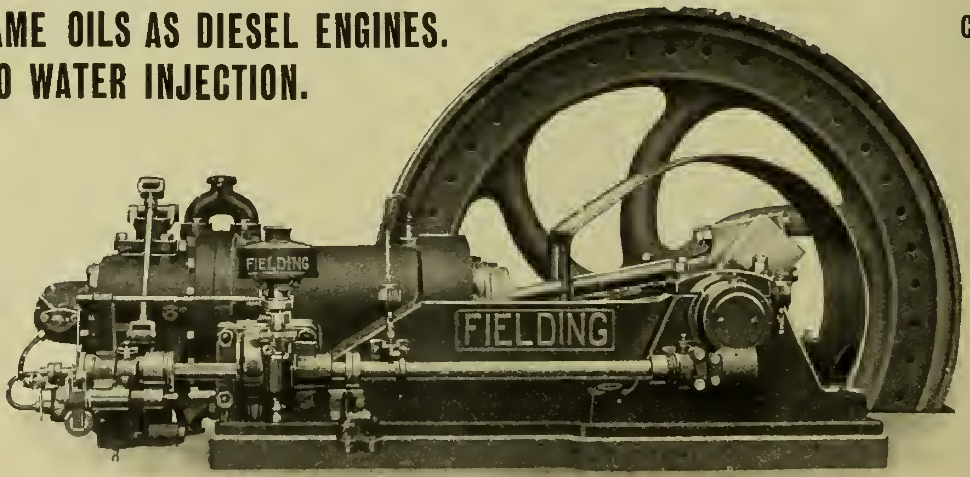

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